DIFFERENTIAL AND DRIVELINE

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PROPELLER SHAFTS

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DESCRIPTION AND OPERATION

PROPELLER SHAFT

DESCRIPTION

A propeller shaft (Fig. 2), (Fig. 3), and (Fig. 4) is the shaft which connects the transmission/transfer case to the axle differential. This is the link through which the engine power is transmitted to the axle.

The propeller shaft is designed and built with the yoke lugs in line with each other which is called zero phasing. This design produces the smoothest running condition, an out-of-phase shaft can cause a vibration.

Tubular propeller shafts are balanced by the manufacturer with weights spot welded to the tube.

PRECAUTIONS

Use the exact replacement parts when installing the propeller shafts. The use of the correct replacement parts helps to ensure safe operation. All fasteners must be torqued to the specified values for safe operation.

Also make alignment reference marks (Fig. 1) on the propeller shaft yoke and axle, or transmission, yoke prior to servicing. This helps to eliminate possible vibration.

CAUTION: Do not allow the propeller shaft to drop or hang from any propeller shaft joint during removal. Attach the propeller shaft to the vehicle underside with wire to prevent damage to the joints.

DESCRIPTION AND OPERATION (Continued)

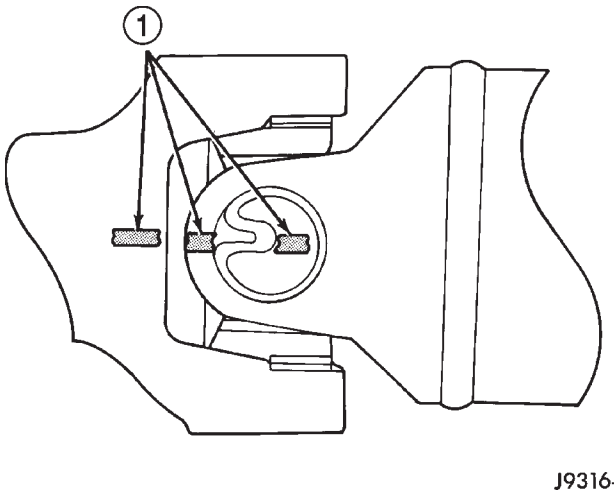


Fig. 1 Reference Marks on Yokes

1 – REFERENCE MARKS

OPERATION

The propeller shaft must operate through constantly changing relative angles between the transmission and axle. It must also be capable of changing length while transmitting torque. The axle rides suspended by springs in a floating motion. The propeller shaft must be able to change operating angles when going over various road surfaces. This is accomplished through universal joints, which permit the propeller shaft to operate at different angles. The slip joints (or yokes) permit contraction or expansion (Fig. 2), (Fig. 3), and (Fig. 4).

Before undercoating a vehicle, the propeller shaft and the U-joints should be covered to prevent an out-of-balance condition and driveline vibration.

CAUTION: Use original equipment replacement parts for attaching the propeller shafts. The specified torque must always be applied when tightening the fasteners.

CENTER BEARING

DESCRIPTION

Vehicles equipped with a two-piece propeller shaft uses a rubber insulated center bearing. The bearing is used to support the shafts where they are joined together.

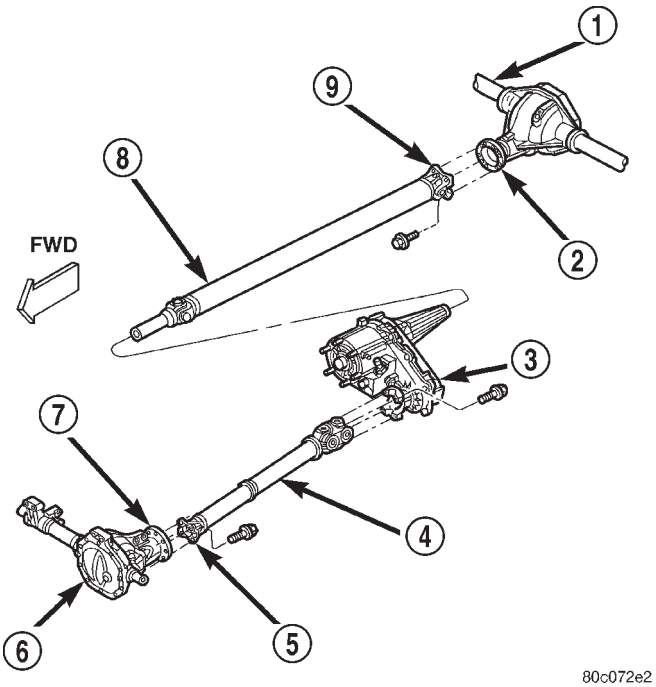


Fig. 2 Front Propeller Shaft

1 – REAR AXLE
2 – COMPANION FLANGE
3 – TRANSFER CASE
4 – FRONT PROPELLER SHAFT
5 – COMPANION YOKE
6 – FRONT AXLE
7 – COMPANION FLANGE
8 – REAR PROPELLER SHAFT
9 – COMPANION YOKE

OPERATION

The propeller shaft center bearing serves to divide the required propeller shaft length into two smaller shafts, which has several inherent advantages. Having two short propeller shafts instead of one long shaft decreases the chance of unwanted noise and vibrations. The shorter shafts are easier to balance and serve to increase ground clearance while maintaining acceptable driveline angles.

DESCRIPTION AND OPERATION (Continued)

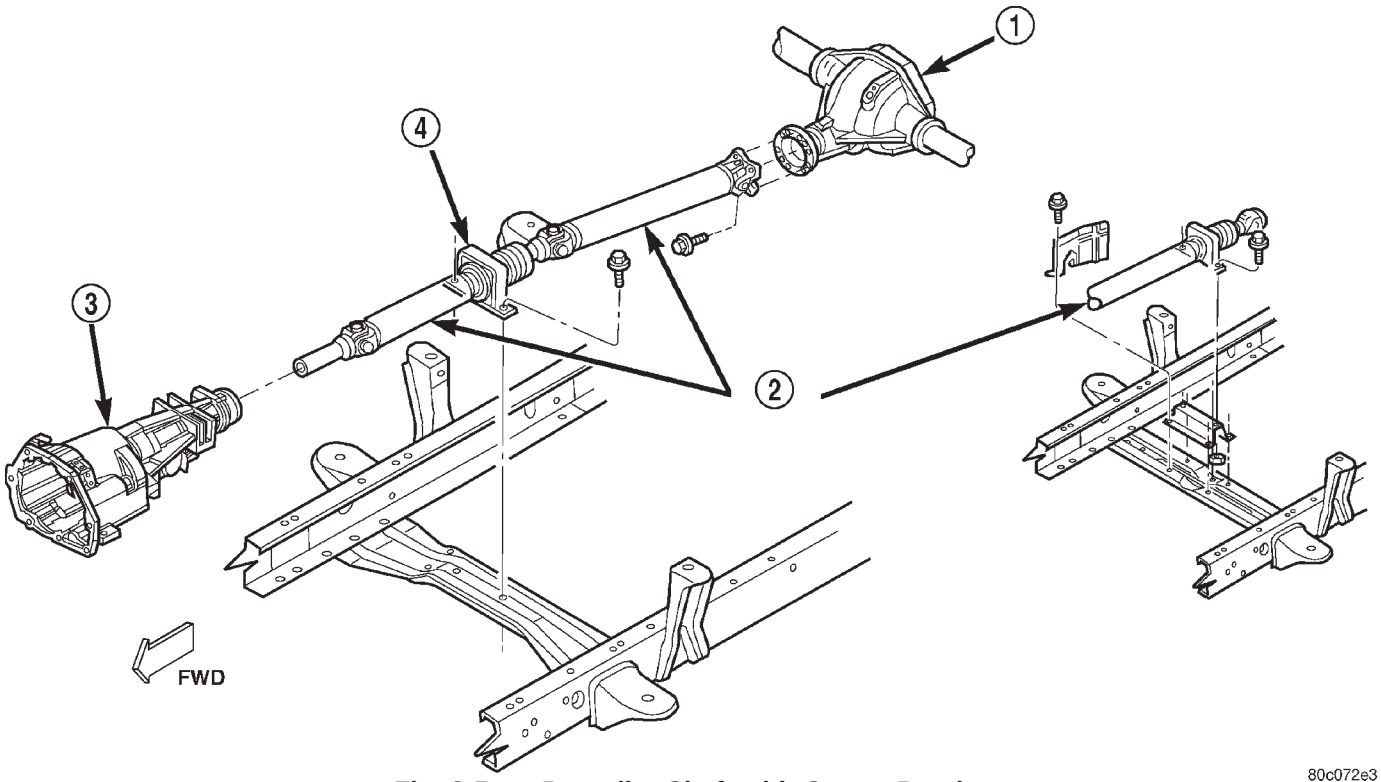


Fig. 3 Rear Propeller Shaft with Center Bearing

1 – REAR AXLE
2 – REAR PROPELLER SHAFT
3 – TRANSMISSION EXTENSION HOUSING
4 – CENTER BEARING

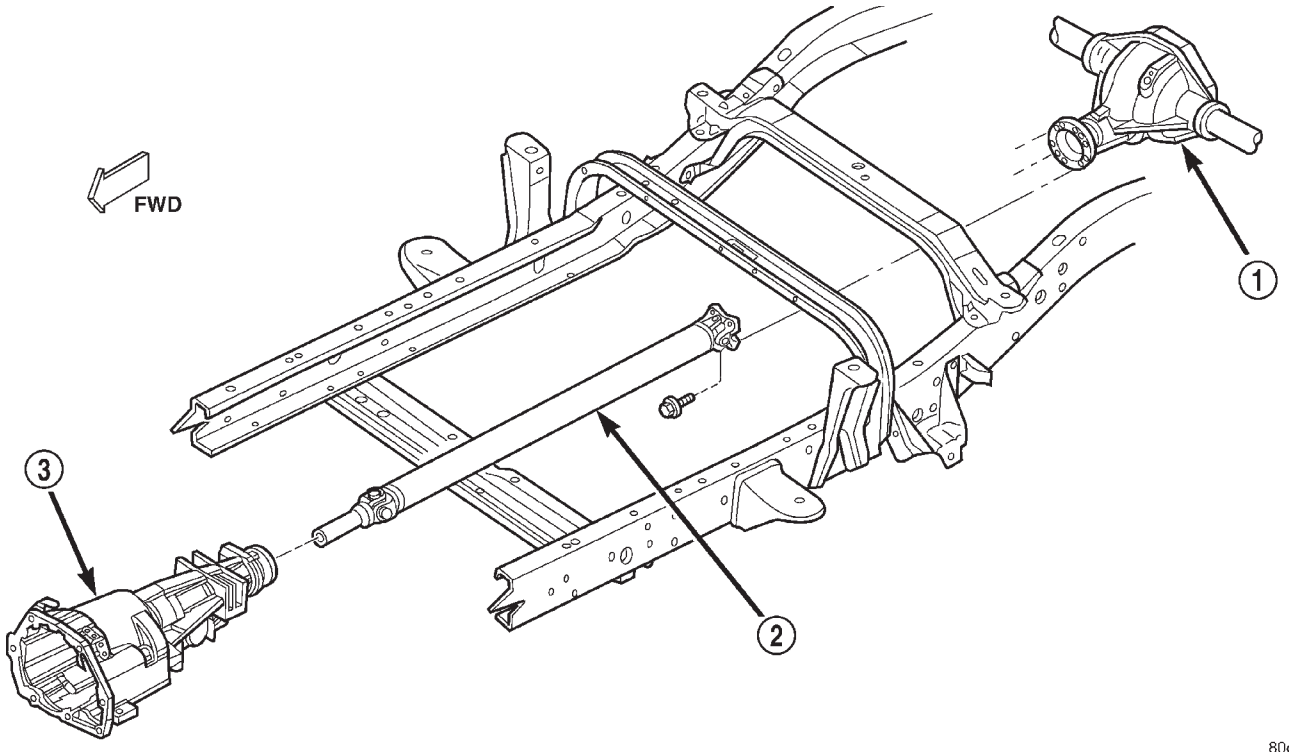


Fig. 4 Rear Propeller Shaft

1 – REAR AXLE
2 – REAR PROPELLER SHAFT
3 – TRANSMISSION EXTENSION HOUSING

DESCRIPTION AND OPERATION (Continued)

PROPELLER SHAFT JOINTS

DESCRIPTION

Two different types of propeller shaft joints are used in AN vehicles (Fig. 5) and (Fig. 6). None of the joints are serviceable. If worn or damaged, they must be replaced as a complete assembly.

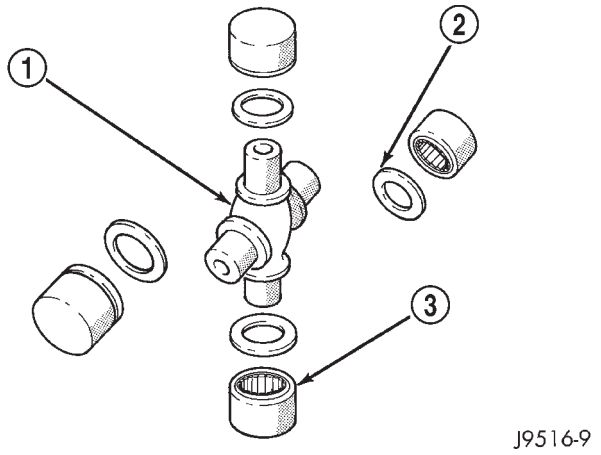


Fig. 5 Single Cardan U-Joint

1 – CROSS
2 – SEAL
3 – CAP AND NEEDLE BEARINGS

LUBRICATION

The factory installed universal joints are lubricated for the life of the vehicle and do not need lubrication. All universal joints should be inspected for leakage and damage each time the vehicle is serviced. If seal leakage or damage exists, the universal joint should be replaced.

PROPELLER SHAFT JOINT ANGLE

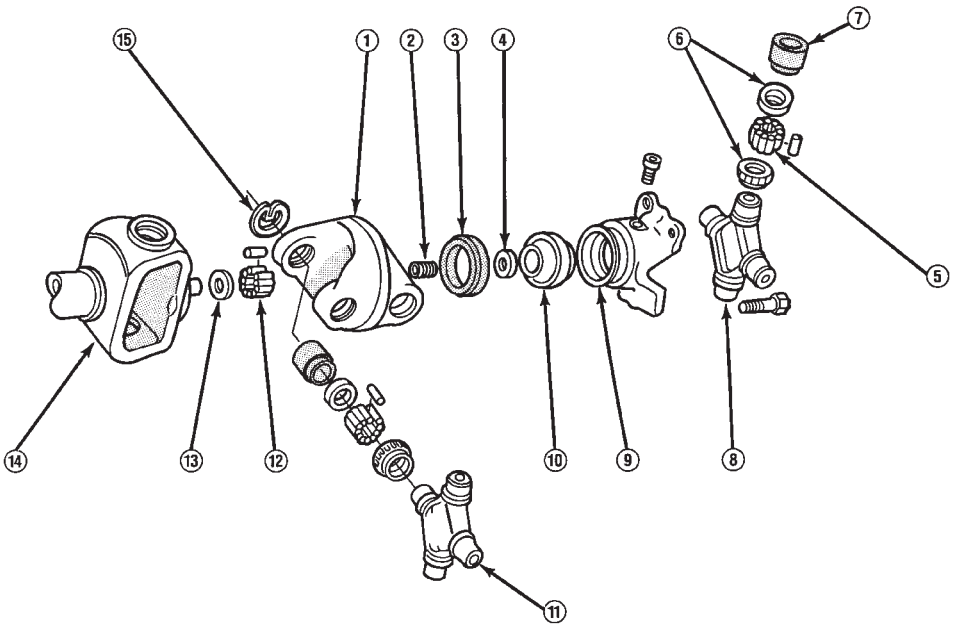
DESCRIPTION

When two shafts come together at a common joint, the bend that is formed is called the operating angle. The larger the angle, the larger the amount of angular acceleration and deceleration of the joint. This speeding up and slowing down of the joint must be cancelled to produce a smooth power flow.

OPERATION

This cancellation is done through the phasing of a propeller shaft and ensuring that the proper propeller shaft joint working angles are maintained.

A propeller shaft is properly phased when the yoke ends are in the same plane, or in line. A twisted shaft will make the yokes out of phase and cause a noticeable vibration.



1. LINK YOKE
2. SOCKET SPRING
3. SOCKET BALL RETAINER
4. THRUST WASHER
5. NEEDLE BEARINGS
6. SEAL
7. BEARING CAP
8. REAR SPIDER
9. SOCKET YOKE
10. SOCKET BALL
11. FRONT SPIDER
12. NEEDLE BEARINGS
13. THRUST WASHER
14. DRIVE SHAFT YOKE
15. RETAINING CLIP

Fig. 6 Double Cardan U-Joint

DESCRIPTION AND OPERATION (Continued)

When taking propeller shaft joint angle measurements, or checking the phasing, of two piece shafts, consider each shaft separately.

Ideally the driveline system should have;

- Angles that are equal or opposite within 1 degree of each other.
- Have a 3 degree maximum operating angle.
- Have at least a 1/2 degree continuous operating (propeller shaft) angle.

Propeller shaft speed (rpm) is the main factor in determining the maximum allowable operating angle. As a guide to the maximum normal operating angles refer to (Fig. 7).

PROPELLER SHAFT R. P. M.	MAX. NORMAL OPERATING ANGLES
5000	3°
4500	3°
4000	4°
3500	5°
3000	5°
2500	7°
2000	8°
1500	11°

Fig. 7 Maximum Angles And Propeller Shaft Speed

DIAGNOSIS AND TESTING

VIBRATION

Tires that are out-of-round, or wheels that are unbalanced, will cause a low frequency vibration. Refer to Group 22, Tires and Wheels, for additional information.

Brake drums that are unbalanced will cause a harsh, low frequency vibration. Refer to Group 5, Brakes, for additional information.

Driveline vibration can also result from loose or damaged engine mounts. Refer to Group 9, Engines, for additional information.

Propeller shaft vibration increases as the vehicle speed is increased. A vibration that occurs within a specific speed range is not usually caused by a propeller shaft being unbalanced. Defective universal joints, or an incorrect propeller shaft angle, are usually the cause of such a vibration.

DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
Propeller Shaft Noise	1) Undercoating or other foreign material on shaft.	1) Clean exterior of shaft and wash with solvent.
	2) Loose U-joint clamp screws.	2) Install new clamps and screws and tighten to proper torque.
	3) Loose or bent U-joint yoke or excessive runout.	3) Install new yoke.
	4) Incorrect driveline angularity.	4) Measure and correct driveline angles.
	5) Rear spring center bolt not in seat.	5) Loosen spring u-bolts and seat center bolt.
	6) Worn U-joint bearings.	6) Install new U-joint.
	7) Propeller shaft damaged or out of balance.	7) Installl new propeller shaft.
	8) Broken rear spring.	8) Install new rear spring.
	9) Excessive runout or unbalanced condition.	9) Re-index propeller shaft, test, and evaluate.
	10) Excessive drive pinion gear shaft runout.	10) Re-index propeller shaft and evaluate.
	11) Excessive axle yoke deflection.	11) Inspect and replace yoke if necessary.
	12) Excessive transfer case runout.	12) Inspect and repair as necessary.
Universal Joint Noise	1) Loose U-joint clamp screws.	1) Install new clamps and screws and tighten to proper torque.
	2) Lack of lubrication.	2) Replace as U-joints as necessary.

DIAGNOSIS AND TESTING (Continued)

UNBALANCE

NOTE: Removing and re-indexing the propeller shaft, 45° at a time, relative to the companion flange may eliminate some vibrations.

If propeller shaft is suspected of being unbalanced, it can be verified with the following procedure:

(1) Raise the vehicle.

(2) Clean all the foreign material from the propeller shaft and the universal joints.

(3) Inspect the propeller shaft for missing balance weights, broken welds, and bent areas. **If the propeller shaft is bent, it must be replaced.**

(4) Inspect the universal joints to ensure that they are not worn, are properly installed, and are correctly aligned with the shaft.

(5) Check the companion flange bolts torque.

(6) Remove the wheels and tires. Install the wheel lug nuts to retain the brake drums or rotors.

(7) Mark and number the shaft six inches from the yoke end at four positions 90° apart.

(8) Run and accelerate the vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.

(9) Install a screw clamp at position 1 (Fig. 8).

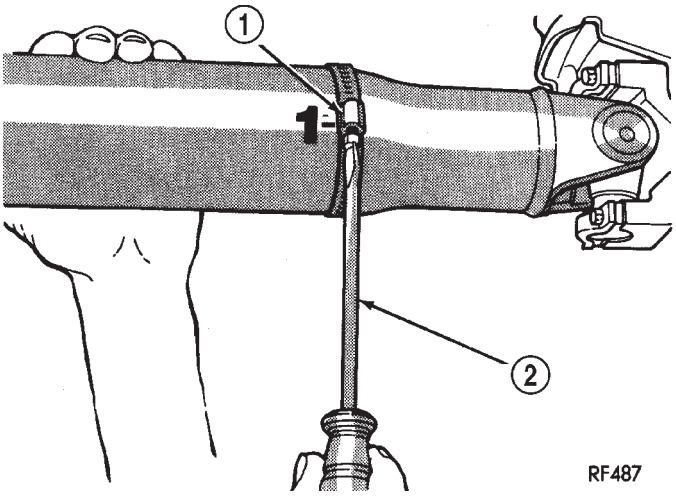


Fig. 8 Clamp Screw At Position 1–Typical

1 – CLAMP
2 – SCREWDRIVER

(10) Start the engine and re-check for vibration. If there is little or no change in vibration, move the clamp to one of the other three positions. Repeat the vibration test.

(11) If there is no difference in vibration at the other positions, the source of the vibration may not be propeller shaft.

(12) If the vibration decreased, install a second clamp (Fig. 9) and repeat the test.

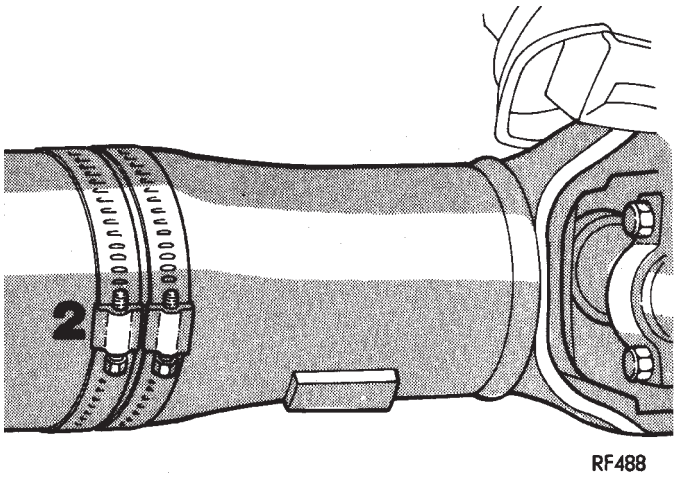


Fig. 9 Two Clamp Screws At The Same Position–Typical

(13) If the additional clamp causes an additional vibration, separate the clamps (1/4 inch above and below the mark). Repeat the vibration test (Fig. 10).

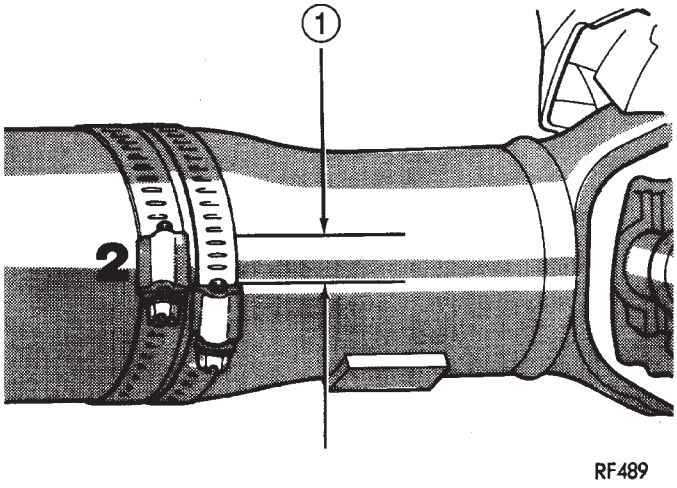


Fig. 10 Clamp Screws Separated–Typical

1 – ½ INCH

(14) Increase distance between the clamp screws and repeat the test until the amount of vibration is at the lowest level. Bend the slack end of the clamps so the screws will not loosen.

(15) If the vibration remains unacceptable, apply the same steps to the front end of the propeller shaft.

(16) Install the wheel and tires. Lower the vehicle.

RUNOUT

(1) Remove dirt, rust, paint, and undercoating from the propeller shaft surface where the dial indicator will contact the shaft.

(2) The dial indicator must be installed perpendicular to the shaft surface.

(3) Measure runout at the center and ends of the shaft sufficiently far away from weld areas to ensure

DIAGNOSIS AND TESTING (Continued)

that the effects of the weld process will not enter into the measurements.

(4) Refer to Runout Specifications chart.

(5) If the propeller shaft runout is out of specification, remove the propeller shaft, index the shaft 45°, and re-install the propeller shaft. Measure shaft runout again.

(6) If the propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.

(7) If the propeller shaft runout is not within specifications, verify that the runout of the transmission/transfer case and axle are within specifications. Correct as necessary and re-measure propeller shaft runout.

(8) Replace the propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

Front of Shaft	0.020 in. (0.50 mm)
Center of Shaft	0.025 in. (0.63 mm)
Rear of Shaft	0.020 in. (0.50 mm)
Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.	

SERVICE PROCEDURES

DRIVELINE ANGLE MEASUREMENT PREPARATION

Before measuring universal joint angles, the following must be done;

- Inflate all tires to correct pressure.
- Check the angles in the same loaded or unloaded condition as when the vibration occurred. Propeller shaft angles change according to the amount of load in the vehicle.
- Check the condition of all suspension components and verify all fasteners are torqued to specifications.
- Check the condition of the engine and transmission mounts and verify all fasteners are torqued to specifications.

PROPELLER SHAFT ANGLE MEASUREMENT

NOTE: The following procedure is depicted using an axle equipped with a pinion yoke. The procedure and principles are the same for axles equipped with a companion flange.

ONE-PIECE PROPELLER SHAFT

To accurately check driveline alignment, raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn. Remove any external bearing snap rings (if equipped) from universal joint so that the inclinometer base sits flat.

(1) Rotate the shaft until transmission/transfer case output yoke bearing cap is facing downward.

Always make measurements from front to rear.

(2) Place Inclinometer on yoke bearing cap (A) parallel to the shaft (Fig. 11). Center bubble in sight glass and record measurement.

This measurement will give you the transmission or Output Yoke Angle (A).

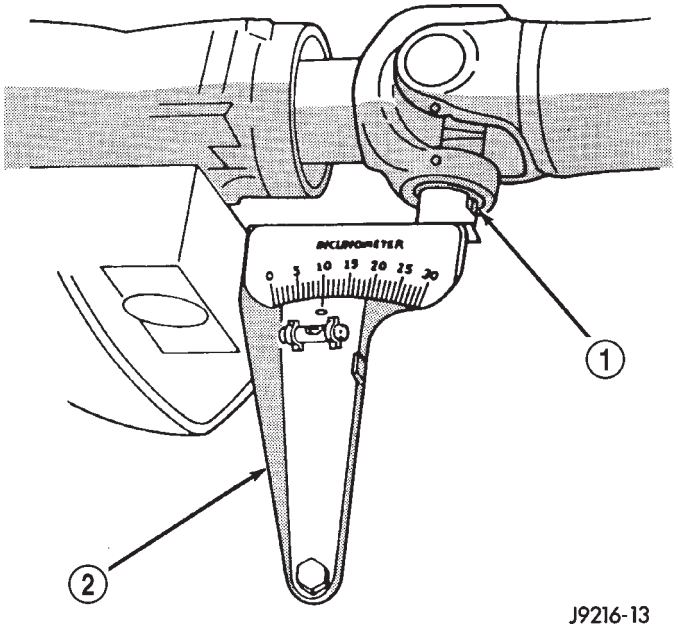


Fig. 11 Front (Output) Angle Measurement (A)

1 – SLIP YOKE BEARING CAP
2 – SPECIAL TOOL 7663 (J-23498A)

SERVICE PROCEDURES (Continued)

(3) Rotate propeller shaft 90 degrees and place Inclinometer on yoke bearing cap parallel to the shaft (Fig. 12). Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft.

This measurement will give you the propeller shaft angle (C).

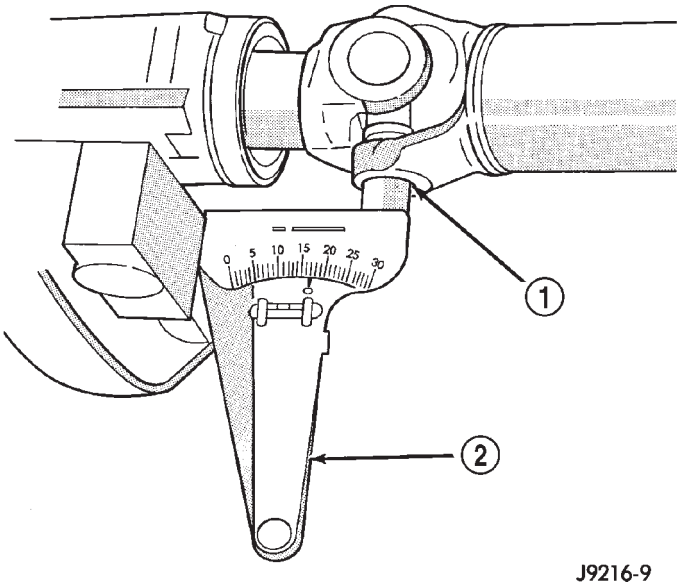


Fig. 12 Propeller Shaft Angle Measurement (C)

1 – SHAFT YOKE BEARING CAP
2 – SPECIAL TOOL 7663 (J23498–A)

(4) Subtract smaller figure from larger (C minus A) to obtain transmission output operating angle.

(5) Rotate propeller shaft 90 degrees and place Inclinometer on pinion yoke bearing cap parallel to the shaft (Fig. 13). Center bubble in sight glass and record measurement.

This measurement will give you the pinion shaft or input yoke angle (B).

(6) Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.

Refer to rules given below and the example in for additional information.

- Good cancellation of U–joint operating angles (within 1°).
- Operating angles less than 3°.
- At least 1/2 of one degree continuous operating (propeller shaft) angle.

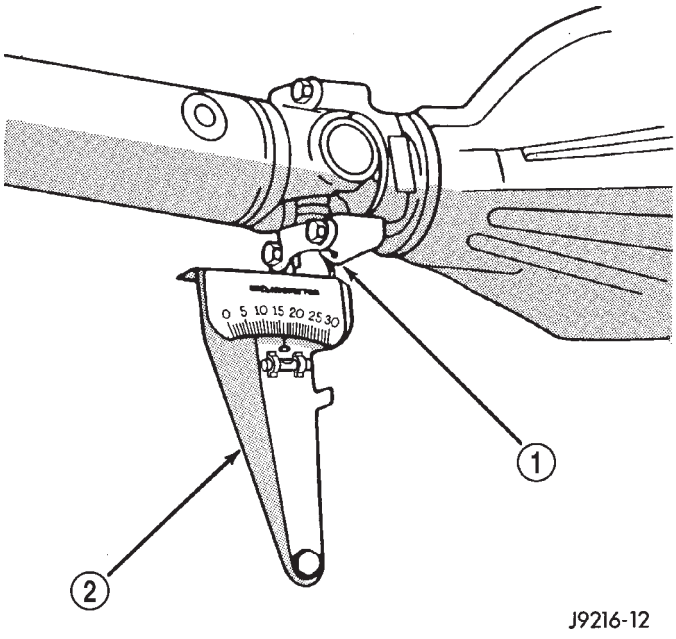


Fig. 13 Rear (Input) Angle Measurement (B)

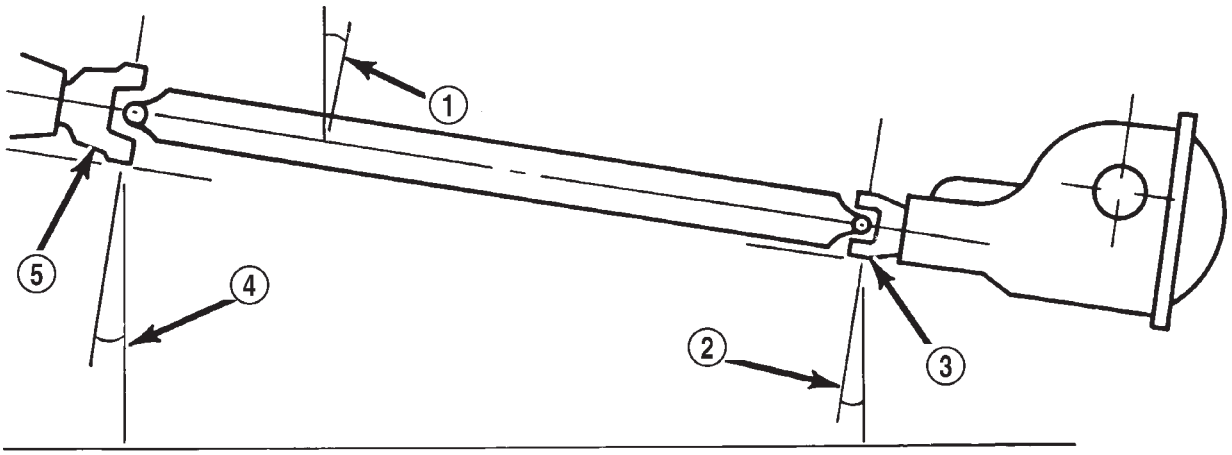
1 – PINION YOKE BEARING CAP
2 – SPECIAL TOOL 7663 (J-23498A)

TWO-PIECE PROPELLER SHAFT

The procedure to measure the propeller shaft angles involved with a two-piece propeller shaft is the same as those for a one-piece propeller shaft. The following additional conditions also apply:

- The front half-shaft must be parallel to the rear axle pinion shaft.
- The front and rear half-shafts must be offset by a minimum of 1/2 of a degree. From the transmission/transfer case output shaft and from each other.
- Excessive variation in measurement angles of A, B or C indicate propeller mis-alignment.
- Vertical alignment of a two-piece shaft at the yokes should be greater than one-half degree and as close to one degree as possible.

SERVICE PROCEDURES (Continued)



(A) Output Yoke	= 3.0° or 4.9°	(B) Axle Input Yoke	= 3.2° or 4.9°
(C) Prop. Shaft	= 4.9° or -3.0°	(C) Prop. Shaft	= 4.9° or -3.2°
Transmission Output Operating Angle	1.9°	Axle Input Operating Angle	1.7°

Trans. Output Operating Angle	1.9°
Axle Input Operating Angle	-1.7°
Amount of U-Joint Cancellation	0.2°

J9316-3

Fig. 14 Universal Joint Angle Example

1 – 4.9° Angle (C)
2 – 3.2° Angle (B)
3 – Input Yoke
4 – 3.0° Angle (A)
5 – Output Yoke

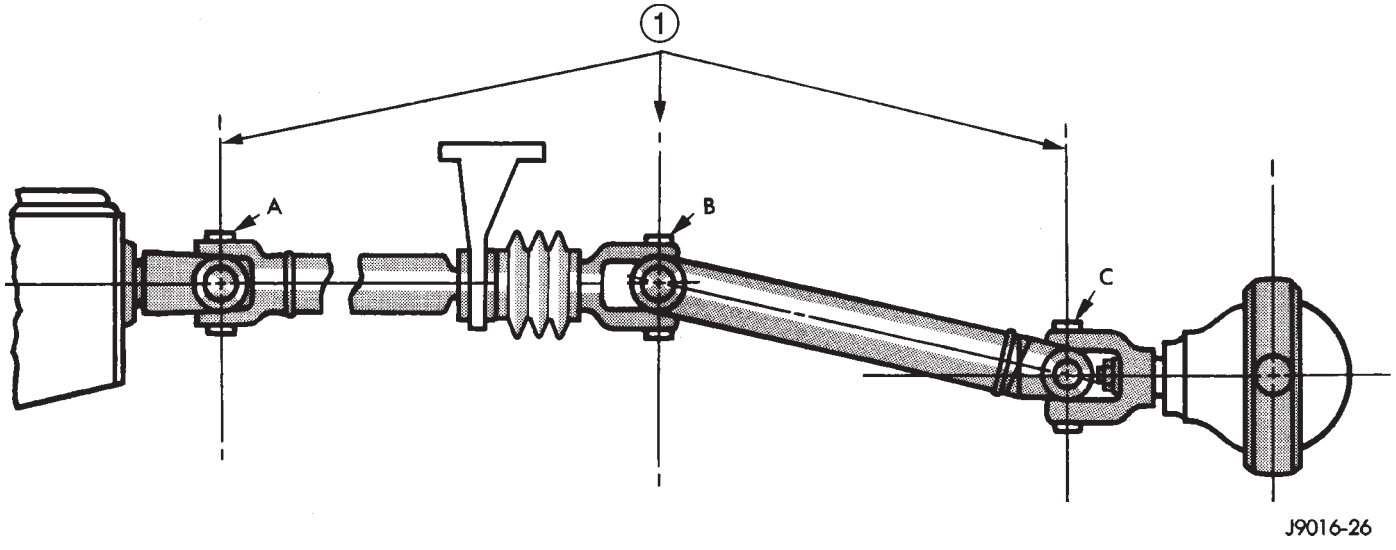


Fig. 15 Universal Joint Angle—Two-Piece Shaft

1 – YOKES MUST BE IN SAME PLANE

REMOVAL AND INSTALLATION

FRONT PROPELLER SHAFT

REMOVAL

(1) Shift the transmission and transfer case to their neutral positions. Raise and support vehicle. Remove skid plate, if equipped.

(2) Using a suitable marker, mark a line across the yoke at the transfer case, the link yoke, and propeller shaft yoke at the rear of the front propeller shaft for installation reference.

(3) Mark a line across the propeller shaft companion yoke and flange at the front axle for installation reference.

(4) Remove the bolts holding the companion yoke to the companion flange (Fig. 16).

(5) Remove the bolts holding the propeller shaft to the transfer case yoke.

(6) Remove the propeller shaft.

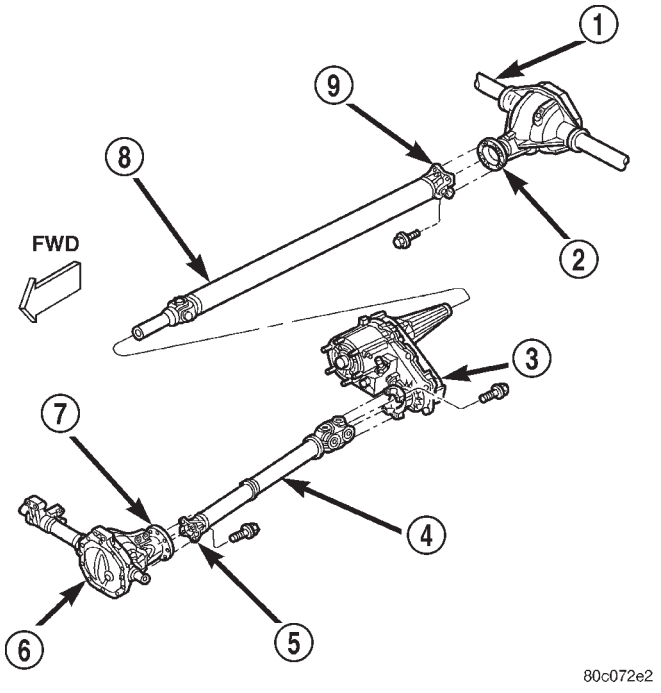


Fig. 16 Front Propeller Shaft

1 – REAR AXLE
2 – COMPANION FLANGE
3 – TRANSFER CASE
4 – FRONT PROPELLER SHAFT
5 – COMPANION YOKE
6 – FRONT AXLE
7 – COMPANION FLANGE
8 – REAR PROPELLER SHAFT
9 – COMPANION YOKE

INSTALLATION

(1) Position front propeller shaft under vehicle with rear universal joint over the transfer case yoke flange.

(2) Place front companion yoke into the axle companion flange.

(3) Align mark on the link yoke and universal joint to the mark on the transfer case yoke flange.

(4) Loosely install bolts to hold universal joint to transfer case yoke.

(5) Align the mark on companion yoke to the mark on the companion flange.

(6) Install bolts to hold the companion yoke to the companion flange. Tighten bolts to 108 N·m (80 ft. lbs.).

(7) Tighten bolts to hold universal joint to transfer case yoke to 27 N·m (20 ft. lbs.).

(8) Install skid plate, if equipped.

(9) Lower vehicle and road test to verify repair.

REAR PROPELLER SHAFT

REMOVAL

(1) Raise and support vehicle on safety stands.

(2) Shift the transmission to the Neutral position.

(3) Using a suitable marker, mark a line across the axle companion flange and yoke for installation reference.

(4) Using a suitable marker, mark the outline of the center bearing on the support bracket for installation reference, if equipped.

(5) Using a suitable marker, mark the outline of the heat shield on the center bearing for installation reference, if equipped.

(6) Remove bolts that attach the center bearing and heat shield to the support bracket, if equipped.

(7) Remove the bolts holding the companion yoke to the companion flange.

(8) Slide the slip yoke off of the transmission, or transfer case, output shaft and remove the propeller shaft (Fig. 17).

INSTALLATION

(1) Slide the slip yoke onto the transmission, or transfer case, output shaft.

(2) Align and install the center bearing and heat shield to the support bracket, if necessary.

(3) Install the bolts and tighten to 68 N·m (50 ft. lbs.) torque.

(4) Align the installation reference marks made on the companion flange and yoke.

(5) Position the companion yoke onto the companion flange.

(6) Install the bolts to hold the companion yoke to the companion flange. Tighten the bolts to 108 N·m (80 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

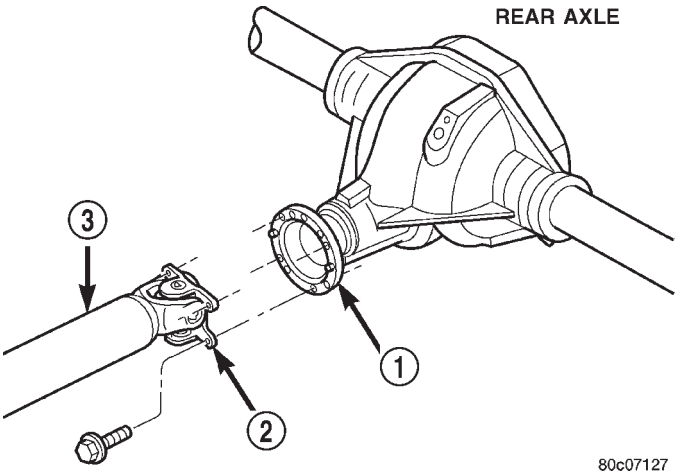


Fig. 17 Rear Propeller Shaft

1 – COMPANION FLANGE
2 – COMPANION YOKE
3 – REAR PROPELLER SHAFT

(7) Lower the vehicle.

CENTER BEARING

REMOVAL

(1) Remove rear propeller shaft.
(2) Remove slip joint boot clamp and separate the two half-shafts.
(3) Use hammer and punch to tap slinger away from shaft to provide room for bearing splitter.
(4) Position Bearing Splitter Tool 1130 between slinger and shaft.

CAUTION: Do not damage shaft spline during removal of center bearing.

(5) Set shaft in press and press bearing off the shaft.

INSTALLATION

(1) Install new slinger on shaft and drive into position with appropriate installer tool.
(2) Install new center bearing on shaft with Bearing Installer Tool 6052. Drive on shaft with hammer until bearing is seated.
(3) Clean shaft splines and apply a coat of multi–purpose grease.
(4) Align master splines and slide front and rear half-shafts together. Reposition slip yoke boot and install new clamp.
(5) Install propeller shaft in vehicle.

DISASSEMBLY AND ASSEMBLY

SINGLE CARDAN UNIVERSAL JOINT

NOTE: The following procedure is described for a propeller shaft equipped with only a cardan joint in the tube yoke. If the propeller shaft is equipped with a companion yoke, simply repeat the following steps to remove the cardan joint from the companion yoke after removing the cardan joint from the tube yoke.

DISASSEMBLY

Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.
(1) Remove the propeller shaft.
(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.
(3) Remove snap rings from both sides of yoke (Fig. 18).

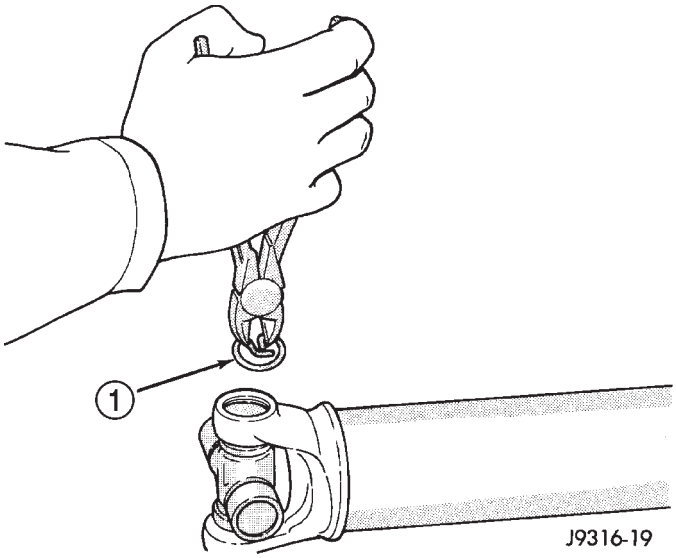


Fig. 18 Remove Snap Ring

1 – SNAP RING

(4) Set the yoke in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the yoke.
(5) Position the yoke with the grease fitting, if equipped, pointing up.

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and press the cap through the yoke to release the lower bearing cap (Fig. 19).

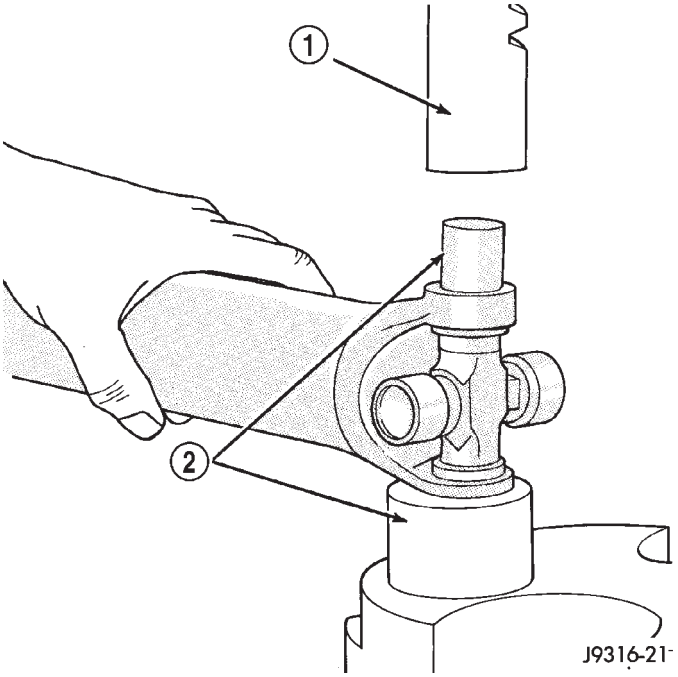


Fig. 19 Press Out Bearing

1 – PRESS
2 – SOCKET

(7) If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.

(8) To remove the opposite bearing cap, turn the yoke over and straighten the cross in the open hole. Then, carefully press the end of the cross until the remaining bearing cap can be removed (Fig. 20).

CAUTION: If the cross or bearing cap are not straight during installation, the bearing cap will score the walls of the yoke bore and damage can occur.

ASSEMBLY

(1) Apply extreme pressure (EP) N. L. G. I. Grade 1 or 2 grease to inside of yoke bores to aid in installation.

(2) Position the cross in the yoke with its lube fitting, if equipped, pointing up (Fig. 21).

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 22). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.

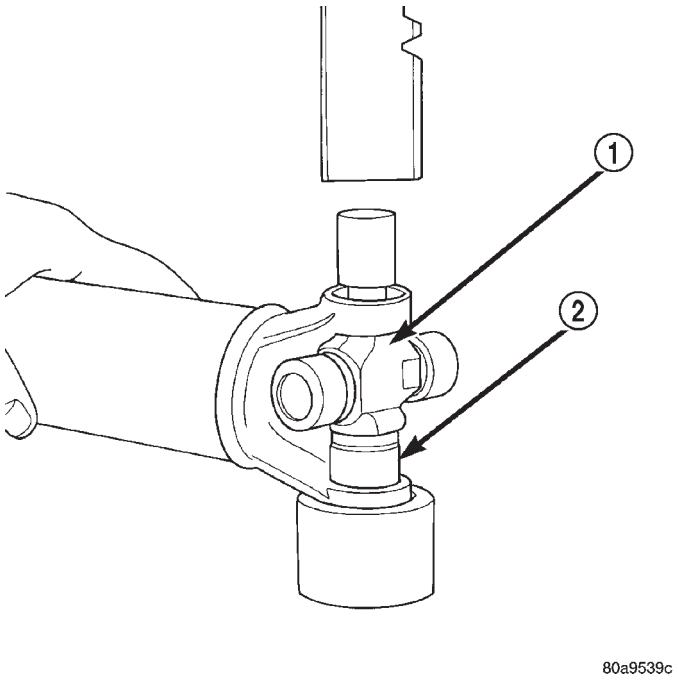


Fig. 20 Press Out Remaining Bearing

1 – CROSS
2 – BEARING CAP

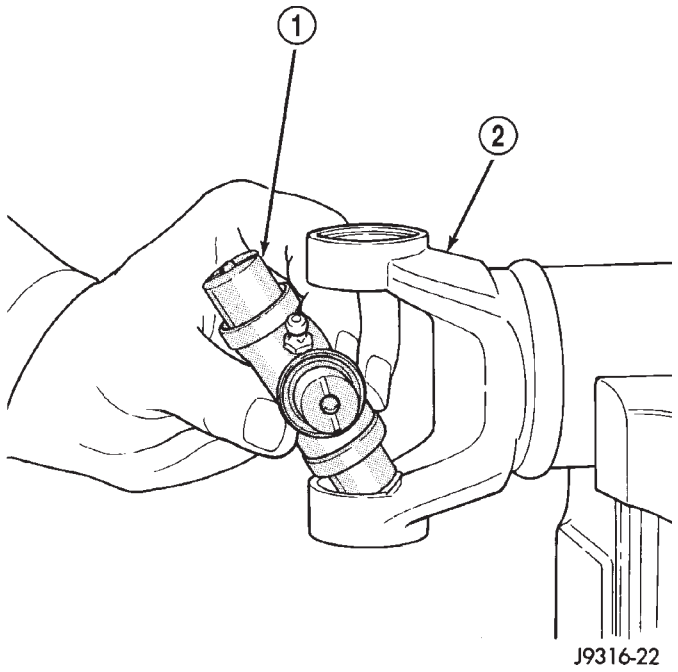


Fig. 21 Install Cross In Yoke

1 – CROSS
2 – YOKE

(4) Press the bearing cap into the yoke bore enough to install a snap ring.

(5) Install a snap ring.

DISASSEMBLY AND ASSEMBLY (Continued)

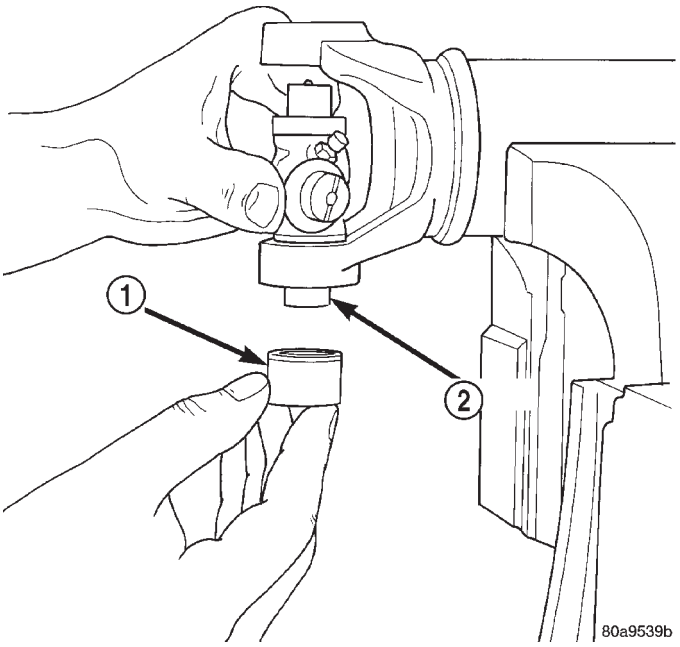


Fig. 22 Install Bearing On Trunnion

1 – BEARING CAP
2 – TRUNNION

(6) Repeat Step 3 and Step 4 to install the opposite bearing cap. If the joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.

(7) Add grease to lube fitting, if equipped.

(8) Install the propeller shaft.

DOUBLE CARDAN JOINT

DISASSEMBLY

Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.

(1) Remove the propeller shaft.

(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.

(3) Remove all the bearing cap snap rings (Fig. 23).

(4) Set the joint in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the link yoke.

(5) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and partially press one bearing cap from the outboard side of the link yoke enough to grasp the bearing cap with vise jaws (Fig. 24). Be sure to remove grease fittings that interfere with removal.

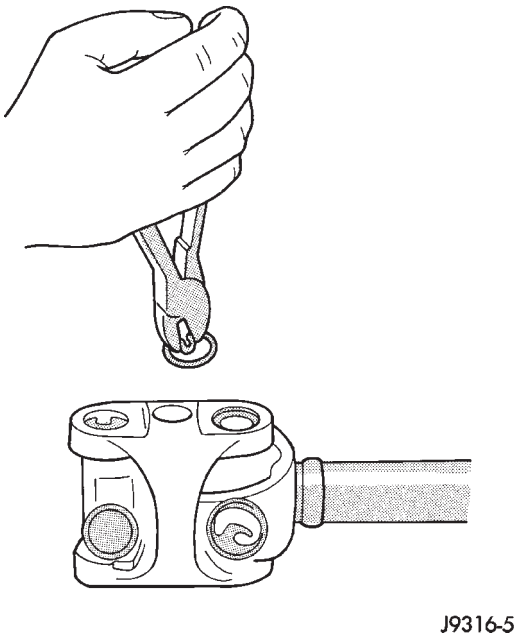


Fig. 23 Remove Snap Rings

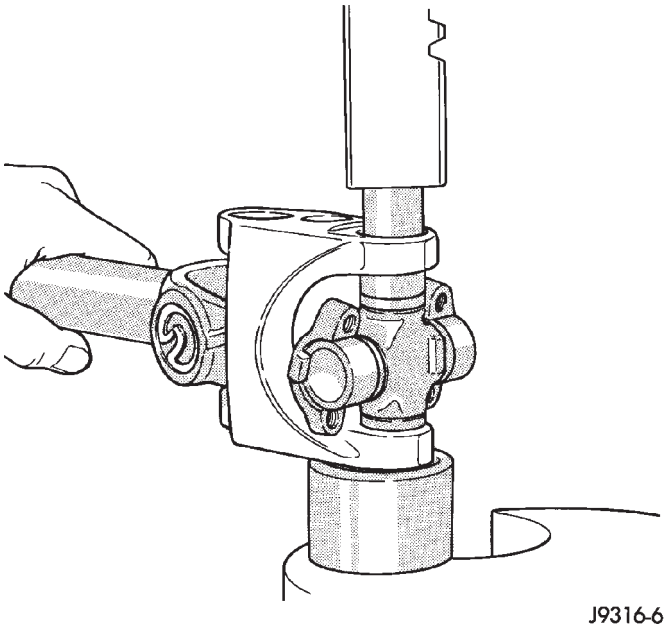


Fig. 24 Press Out Bearing

(6) Grasp the protruding bearing by vise jaws. Tap the link yoke with a mallet and drift to dislodge the bearing cap from the yoke (Fig. 25).

DISASSEMBLY AND ASSEMBLY (Continued)

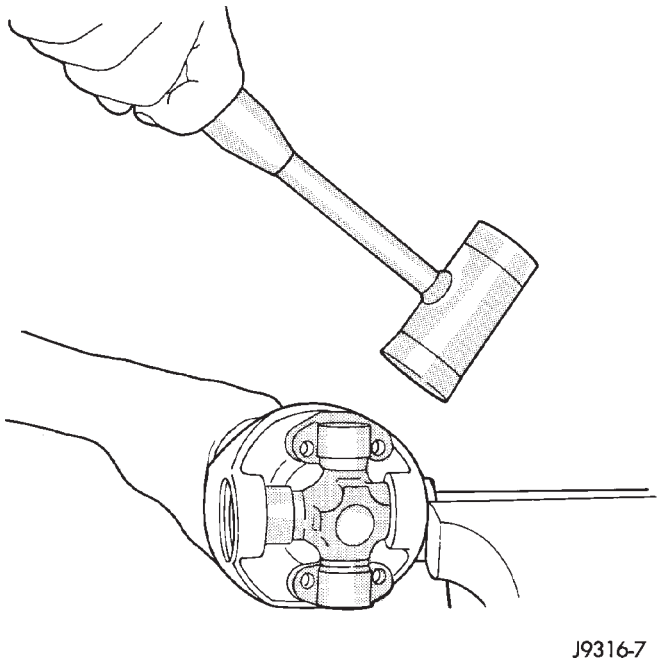


Fig. 25 Remove Bearing From Yoke

(7) Flip assembly and repeat Step 4, Step 5, and Step 6 to remove the opposite bearing cap. This will then allow removal of the cross centering kit assembly and spring (Fig. 26).

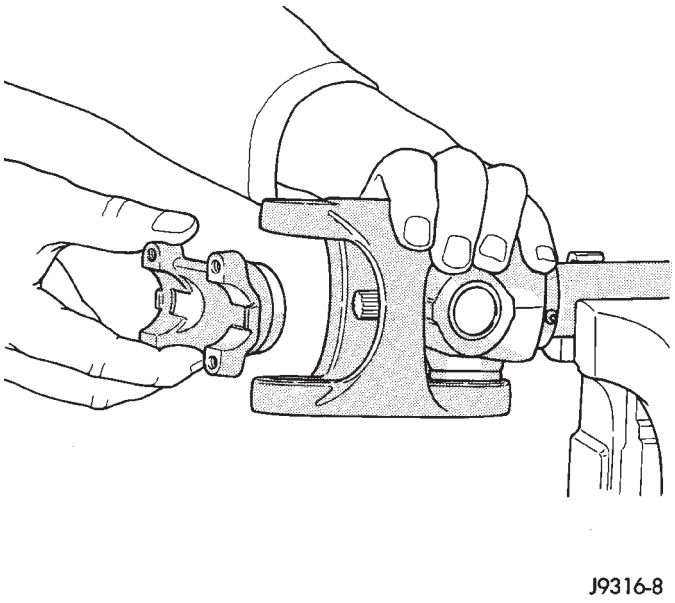


Fig. 26 Remove Centering Kit

(8) Press the remaining bearing caps out the other end of the link yoke as described above to complete the disassembly.

ASSEMBLY

During assembly, ensure that the alignment marks on the link yoke and propeller shaft yoke are aligned.

(1) Apply extreme pressure (EP) N. L. G. I. Grade 1 or 2 grease to inside of yoke bores to aid in installation.

(2) Fit a cross into the propeller shaft yoke (Fig. 27).

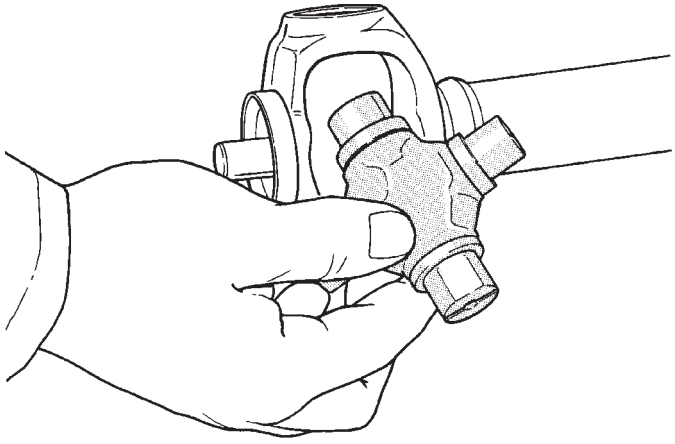


Fig. 27 Install Cross In Yoke

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 28). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.

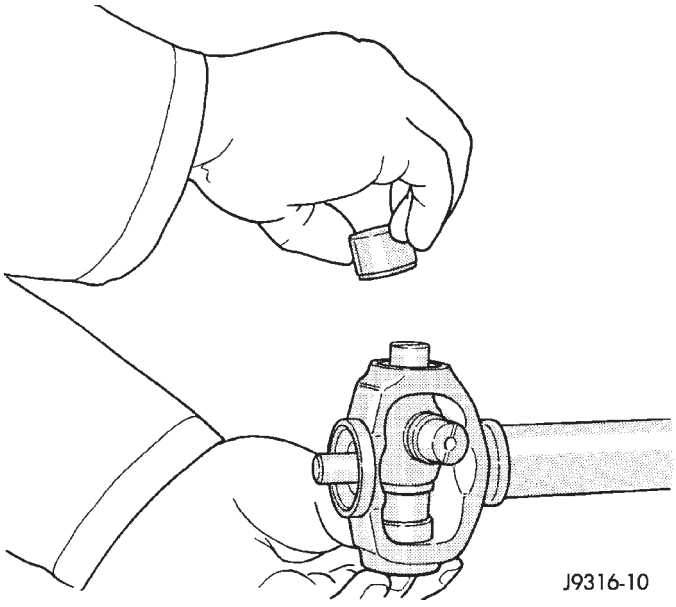


Fig. 28 Install Bearing Cap

(4) Press the bearing cap into the yoke bore enough to install a snap ring (Fig. 29).

(5) Install a snap ring.

(6) Flip the propeller shaft yoke and install the bearing cap onto the opposite trunnion. Install a snap ring (Fig. 30).

DISASSEMBLY AND ASSEMBLY (Continued)

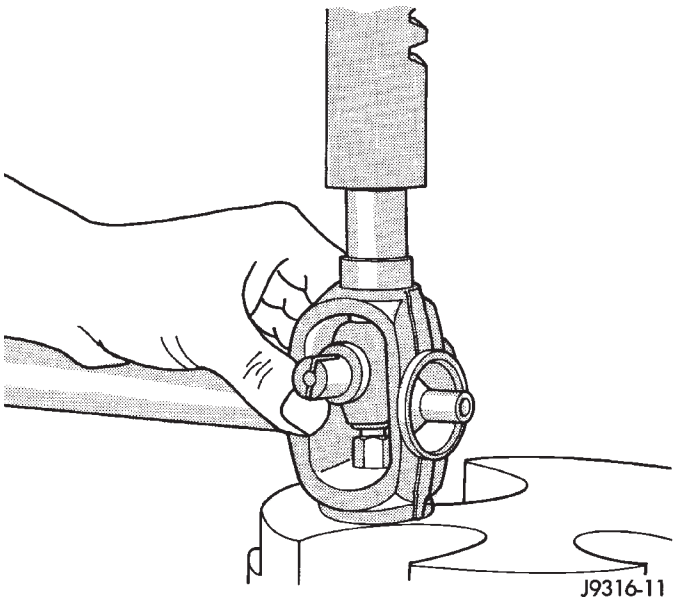


Fig. 29 Press In Bearing Cap

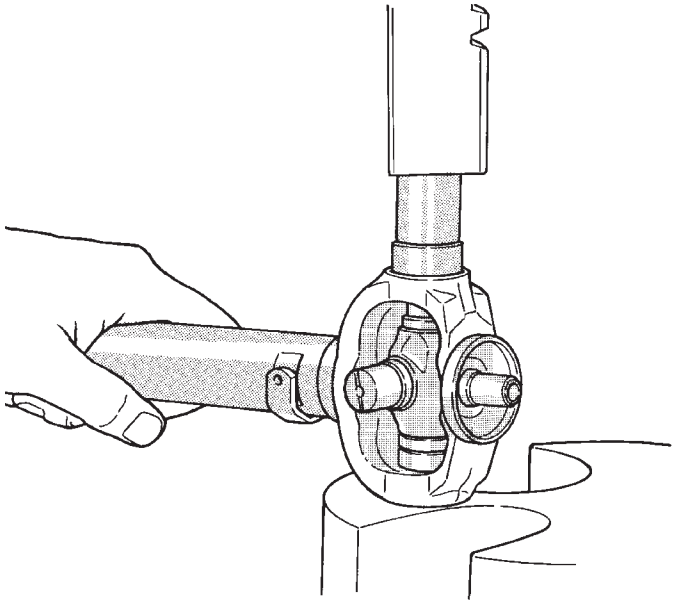


Fig. 30 Press In Bearing Cap

(7) Fit the link yoke on the remaining two trunnions and press both bearing caps into place (Fig. 31).

(8) Install snap rings.

(9) Install the centering kit assembly inside the link yoke making sure the spring is properly positioned (Fig. 32).

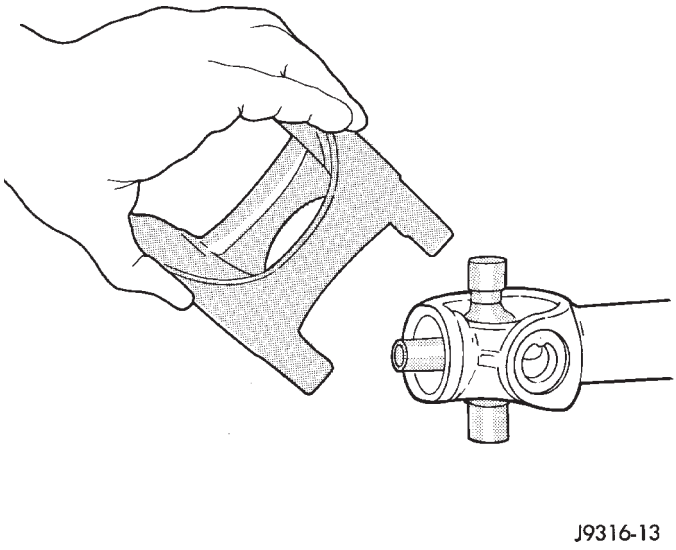


Fig. 31 Install Link Yoke

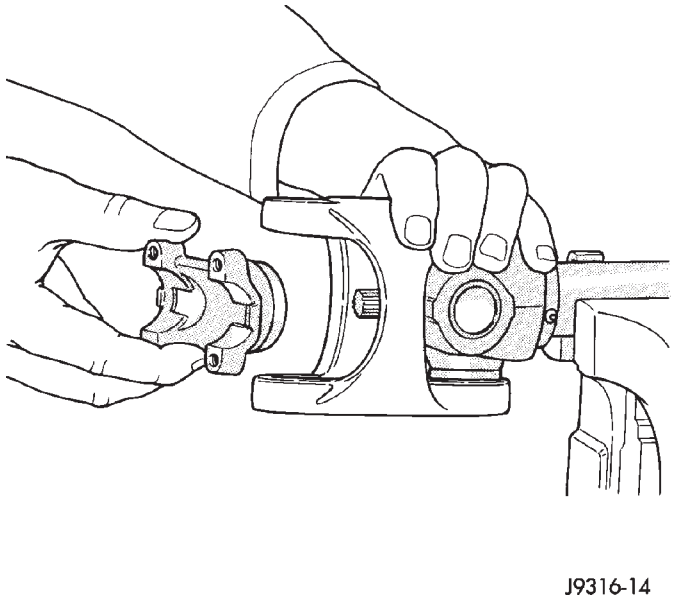


Fig. 32 Install Centering Kit

(10) Place two bearing caps on opposite trunnions of the remaining cross. Fit the open trunnions into the link yoke bores and the bearing caps into the centering kit (Fig. 33).

DISASSEMBLY AND ASSEMBLY (Continued)

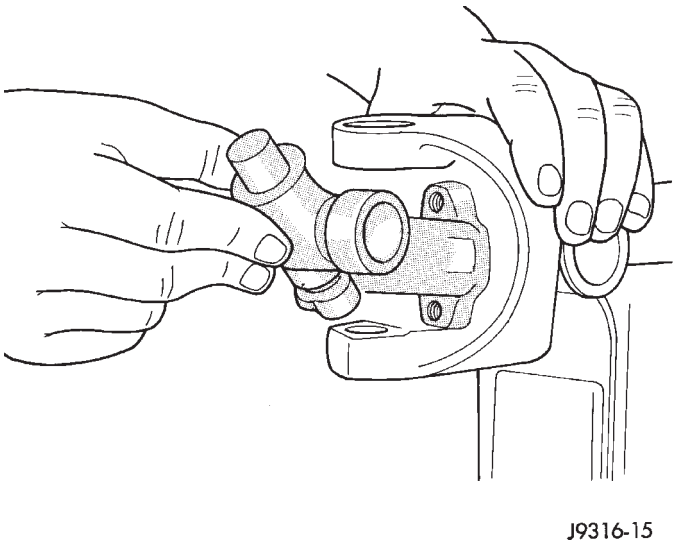


Fig. 33 Install Remaining Cross

(11) Press the remaining two bearing caps into place and install snap rings (Fig. 34).

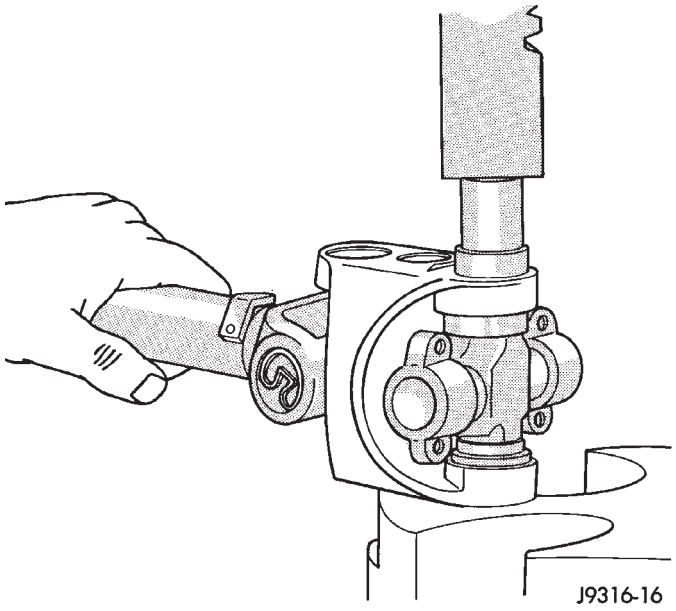


Fig. 34 Press In Bearing Cap

(12) Tap the snap rings to allow them to seat into the grooves (Fig. 35).

(13) Check for proper assembly. Flex the joint beyond center, it should snap over-center in both directions when correctly assembled (Fig. 36).

(14) Install the propeller shaft.

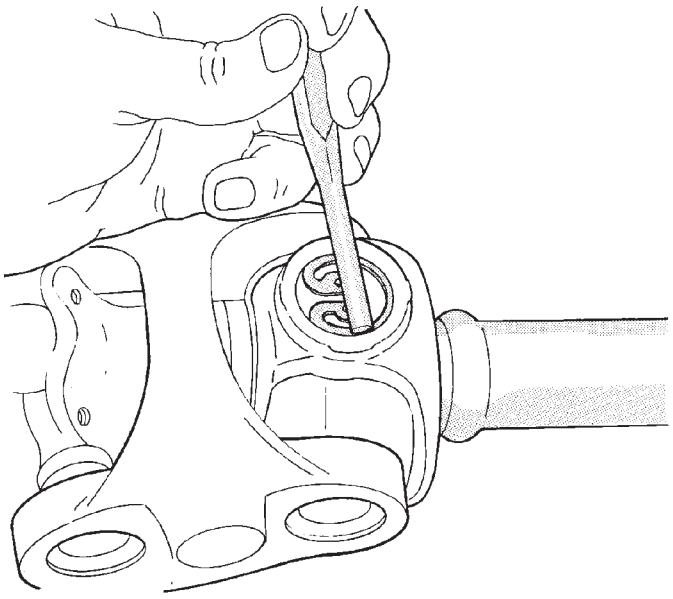


Fig. 35 Seat Snap Rings In Groove

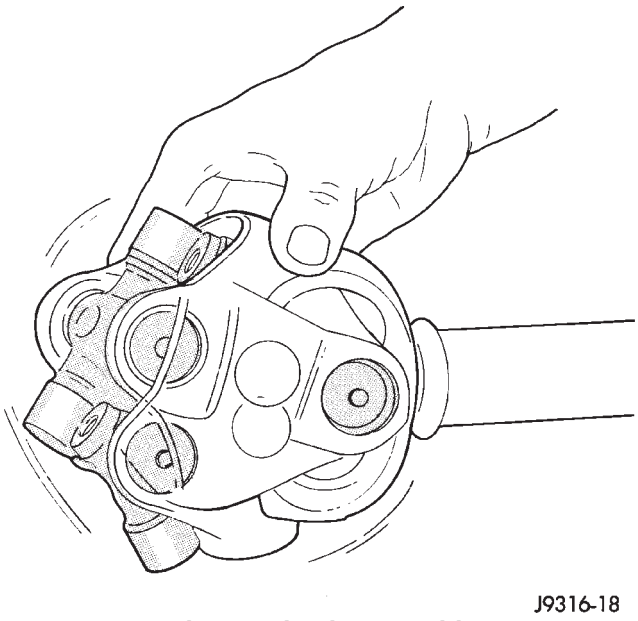


Fig. 36 Check Assembly

CLEANING AND INSPECTION

PROPELLER SHAFT

(1) Clean all universal joint bores with cleaning solvent and a wire brush.

(2) Inspect the yokes for distortion, cracks, and worn bearing cap bores.

ADJUSTMENTS

ADJUSTMENT AT AXLE WITH LEAF SPRINGS

Adjust the pinion shaft angle at the springs with tapered shims (Fig. 37). Install tapered shims between the springs and axle pad to correct the angle. Refer to Group 2, Suspension, for additional information.

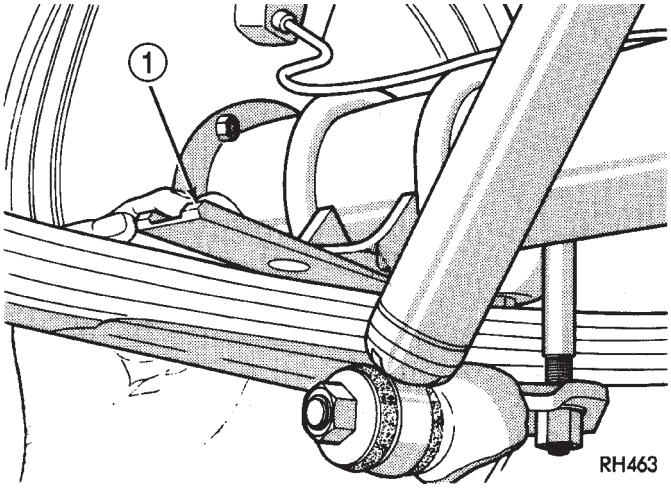


Fig. 37 Angle Adjustment at Leaf Springs

1 – WEDGE

CENTER BEARING ADJUSTMENT

Drive away shudder is a vibration that occurs at first acceleration from a stop. Shudder vibration usually peaks at the engines highest torque output. Shudder is a symptom associated with vehicles using a two-piece propeller shaft. To decrease shudder, lower the center bearing in 1/8 inch increments. Use shim stock or fabricated plates. Plate stock must be used to maintain compression of the rubber insulator around the bearing. Do not use washers. Replace the original bolts with the appropriate increased length bolts.

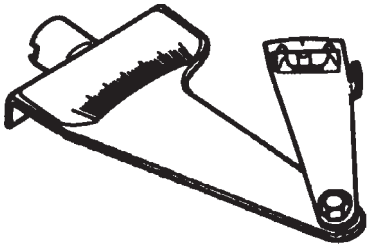
SPECIFICATIONS

TORQUE

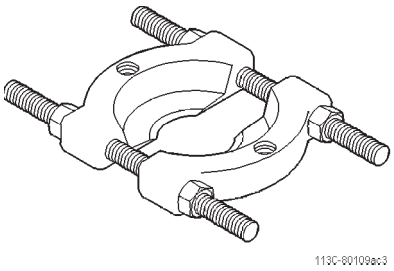
DESCRIPTION	TORQUE
Bolts, Center Bearing	68 N·m (50 ft. lbs.)
Bolts, Transfer Case Yoke . . .	27 N·m (20 ft. lbs.)
Bolts, Companion Flange . .	108 N·m (80 ft. lbs.)

SPECIAL TOOLS

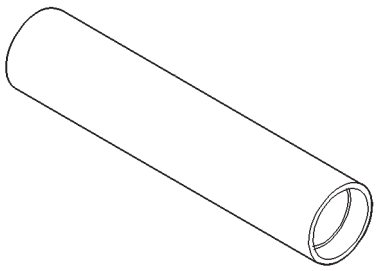
PROPELLER SHAFT



Inclinometer—7663



Bearing Splitter—1130



Installer, Bearing—6052

FRONT AXLE DRIVESHAFTS

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

FRONT AXLE DRIVESHAFTS

DESCRIPTION

The two constant velocity (C/V) drive shafts are identical and interchangeable. They are comprised of three major components (Fig. 1) :

DESCRIPTION AND OPERATION (Continued)

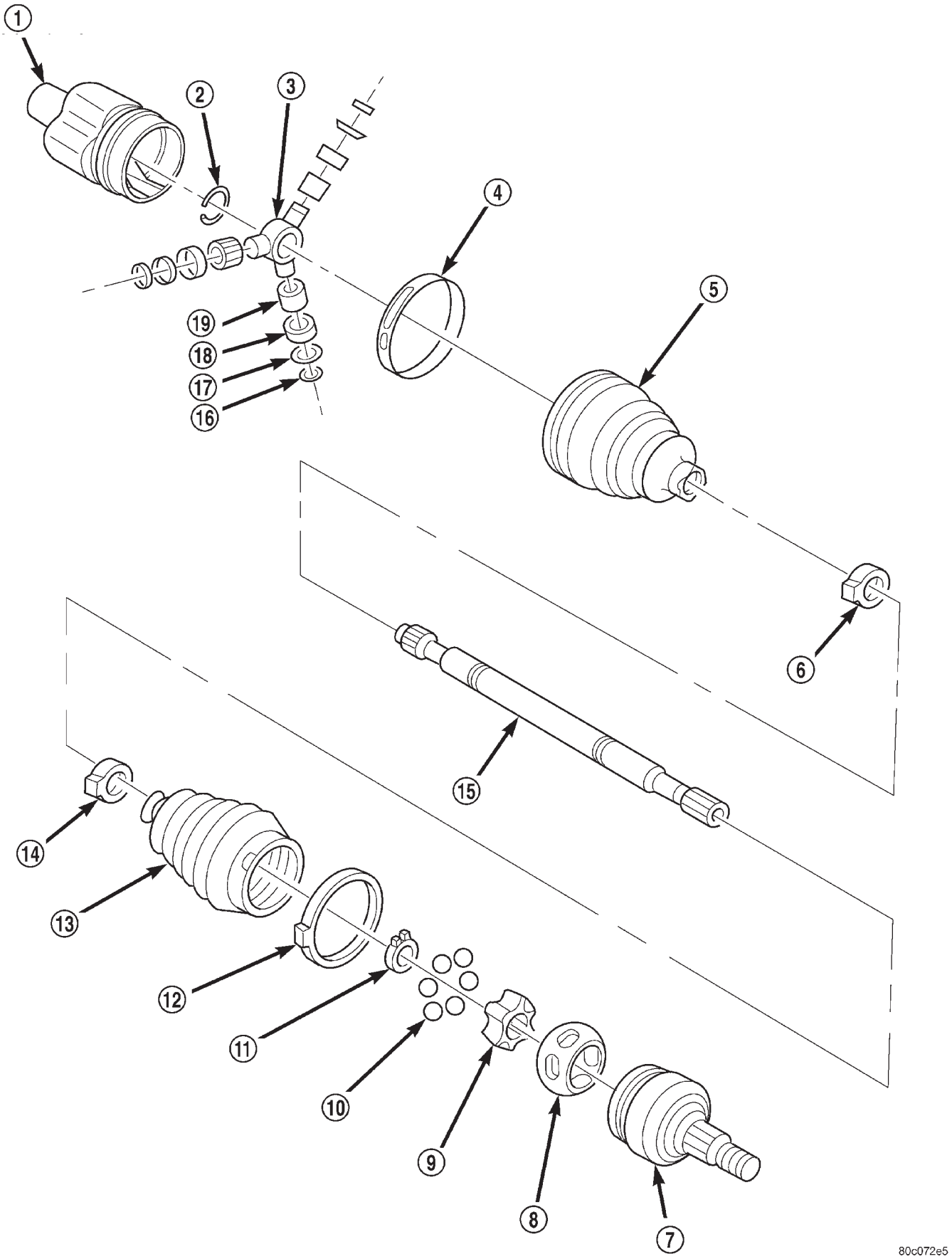


Fig. 1 C/V Drive Shaft Components

DESCRIPTION AND OPERATION (Continued)

1 – RETAINER & HOUSING ASM
2 – C-CLIP
3 – TRIPOD JOINT SPIDER
4 – SEAL RETAINING CLAMP
5 – INNER BOOT
6 – SEAL RETAINING CLAMP
7 – C/V JOINT OUTER RACE
8 – C/V JOINT CAGE
9 – C/V JOINT INNER RACE
10 – CHROME ALLOY BALL
11 – RACE RETAINING RING
12 – SEAL RETAINING CLAMP
13 – DRIVE AXLE OUTBOARD SEAL
14 – SEAL RETAINING CLAMP
15 – AXLE SHAFT
16 – RETAINING RING
17 – BALL & ROLLER RETAINER
18 – TRIPOD JOINT BALL
19 – NEEDLE ROLLER

- An inner, tripod C/V joint
- A short, solid interconnecting shaft
- An outer, Rzeppa C/V joint with stub shaft

The inner tripod-joints are attached to the axle shaft splines (Fig. 1). The outer joint is splined and mates with the hub bearing on the knuckle.

The lubricant amounts included with replacement rubber boots are different for inner and outer C/V joints. Apply only the specified lubricant amount to each C/V joint.

CAUTION: Proper C/V joint boot sealing is critical for retaining the special lubricant. Prevent foreign material from entering and contaminating the C/V joints. Mishandling a C/V drive shaft can cause a boot to be punctured or damage within the joints. Always support both ends of the C/V drive shaft during removal and installation to avoid damage.

When replacing C/V drive shaft components, ensure that only exact replacements parts are installed.

OPERATION

The axle driveshafts are located on either side of the differential and transmits power to the drive wheels, while allowing for vertical movement in the vehicle's suspension.

DIAGNOSIS AND TESTING

VEHICLE INSPECTION

(1) Check for grease in the vicinity of the inboard tripod joint and outboard C/V joint; this is a sign of inner or outer joint seal boot or seal boot clamp damage.

(2) A light film of grease may appear on the right inner tripod joint seal boot; this is considered normal and should not require replacement of the seal boot.

NOISE AND/OR VIBRATION IN TURNS

A clicking noise and/or a vibration in turns could be caused by one of the following conditions:

- Damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss and/or contamination of the joint grease, resulting in inadequate lubrication of the joint.
- Noise may also be caused by another component of the vehicle coming in contact with the driveshafts.

CLUNKING NOISE DURING ACCELERATION

This noise may be a result of one of the following conditions:

- A torn seal boot on the inner or outer joint of the driveshaft assembly which has allowed the C/V joint to become damaged.
- A loose or missing clamp on the inner or outer joint of the driveshaft assembly which has allowed the C/V joint to become damaged.
- A damaged or worn driveshaft C/V joint.

SHUDDER OR VIBRATION DURING ACCELERATION

This problem could be a result of:

- A worn or damaged driveshaft inner tripod joint.
- A sticking tripod joint spider assembly (inner tripod joint only).
- Improper wheel alignment. Refer to Group 2, Suspension, for alignment checking and setting procedures and specifications.

VIBRATION AT HIGHWAY SPEEDS

This problem could be a result of:

- Foreign material (mud, etc.) packed on the backside of the wheel(s).
- Out of balance front tires or wheels. Refer to Group 22, Wheels And Tires, for the required balancing procedure.
- Improper tire and/or wheel runout. Refer to Group 22, Wheels And Tires, for the required runout checking procedure.

REMOVAL AND INSTALLATION

FRONT DRIVESHAFT

REMOVAL

(1) Remove the cotter pin, nut lock, and spring washer from the stub shaft (Fig. 2).

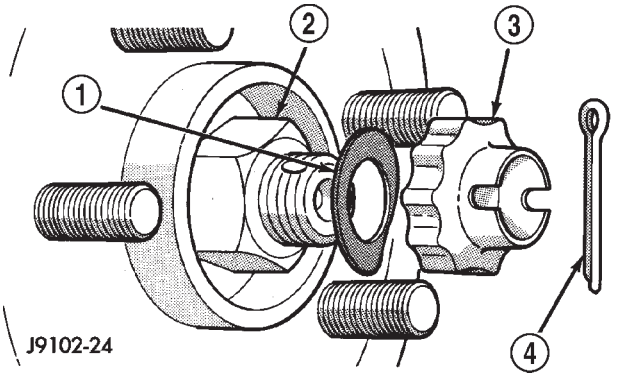


Fig. 2 Cotter Pin, Nut Lock & Spring Washer Removal

1 – SPRING WASHER
2 – HUB NUT
3 – NUT LOCK
4 – COTTER PIN

(2) Loosen the lug nuts and hub nut while the vehicle is on the surface with the brakes applied (Fig. 3).

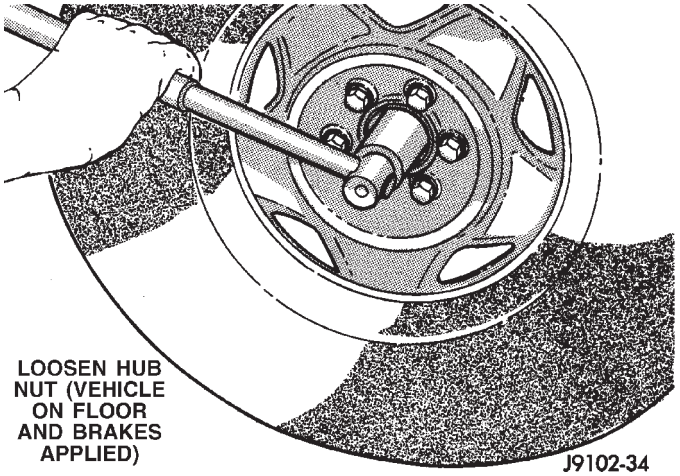


Fig. 3 Loosening Wheel Hub Nut

(3) Raise the vehicle.
(4) Remove the skid plate, if equipped.
(5) Remove the hub nut and washer from the stub shaft (Fig. 4).
(6) Remove the wheel and tire.
(7) Remove the brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.
(8) Remove the ABS wheel speed sensor, if equipped. Refer to Group 5, Brakes, for proper procedures.

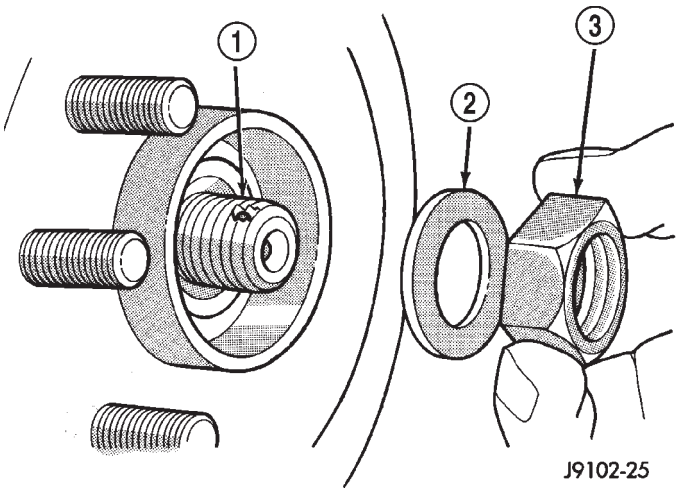


Fig. 4 Hub Nut & Washer

1 – DRIVE SHAFT
2 – HUB WASHER
3 – HUB NUT

(9) Remove the bolts holding the hub bearing to the knuckle.
(10) Remove hub bearing from axle driveshaft and steering knuckle.
(11) Support the drive shaft at the C/V joint housings.
(12) Disengage the inner C/V joint from the axle shaft (Fig. 5). Position two pry bars between the inner C/V housing and the axle housing. Apply pressure away from the differential housing. This will disengage the axle shaft snap-ring from the groove on the inside of the C/V housing.

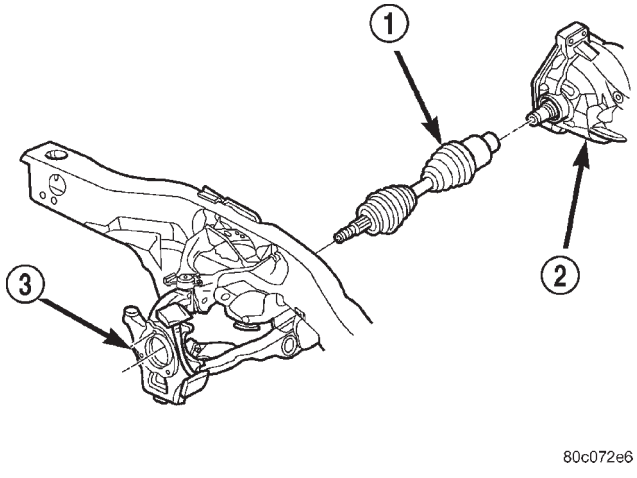


Fig. 5 Front Driveshaft

1 – DRIVESHAFT
2 – FRONT AXLE
3 – STEERING KNUCKLE

(13) Remove the driveshaft from the vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Insert the C/V drive shaft stub into the hub bearing bore of the steering knuckle.

(2) Apply a light coating of wheel bearing grease on the axle shaft splines.

(3) Install the inner C/V joint onto the axle shaft flange. Push firmly on the shaft until the axle shaft snap-ring engages with the groove on the inside of the joint housing.

(4) Clean hub bearing bore, axle driveshaft splines, and hub bearing mating surface of all foreign materials. Apply light coating of grease to all mating surfaces.

(5) Install the hub bearing to the axle driveshaft and the steering knuckle.

(6) Install the bolts to hold the hub bearing to the steering knuckle. Refer to Group 2, Suspension, for the proper torque.

(7) Clean all foreign material from the stub shaft threads. Install the hub nut and washer.

(8) Install the ABS wheel speed sensor, if equipped. Refer to Group 5, Brakes, for proper procedures.

(9) Install the brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.

(10) Apply the brakes and tighten hub nut to 244 N·m (180 ft. lbs.) torque.

(11) Install the spring washer, nut lock and cotter pin on the stub shaft (Fig. 6).

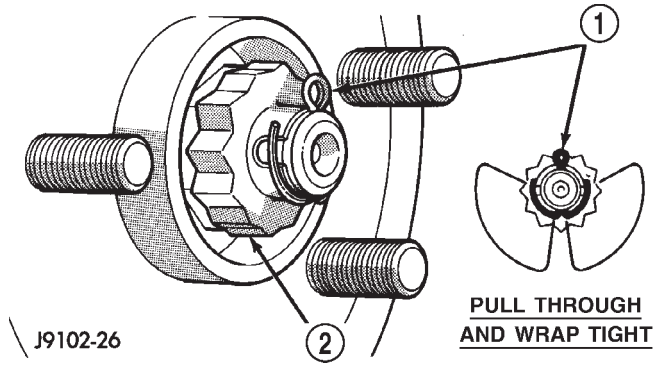


Fig. 6 Cotter Pin Installation

1 – COTTER PIN
2 – NUT LOCK

(12) Install the skid plate, if equipped.

(13) Install the wheel and tire.

C/V JOINT BOOTS

REMOVAL

(1) Remove axle driveshaft from vehicle.

(2) Remove outer C/V joint.

(3) Remove outer C/V joint small clamp and remove boot (Fig. 7).

(4) Remove inner C/V joint boot clamps and remove boot.

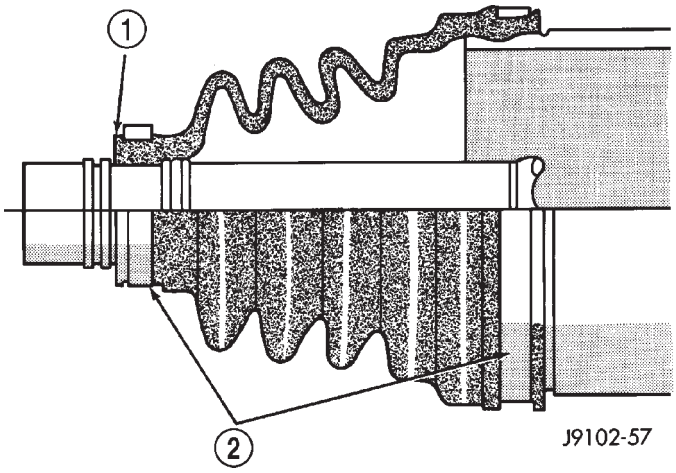


Fig. 7 Boot Retaining Clamp Locations

1 – POSITION ON FLAT BETWEEN LOCATING SHOULDERS
2 – CLAMPS

INSTALLATION

The lubricant amounts included with replacement boots are different for inner and outer C/V joints. Apply only the specified lubricant amount to each C/V joint.

(1) Clean the C/V joints and shaft of all old grease and foreign matter.

(2) Slide the inner C/V joint boot up the shaft and insert the lip located within the small-diameter end of the boot into the shaft groove (Fig. 7).

(3) Retain the small–diameter of the boot on the shaft with a ladder-type clamp in the boot groove (Fig. 7). Verify that the boot and lip are properly positioned on the intermediate shaft. Position the clamp locating tabs in the slots and tighten the clamp.

(4) Compress the clamp bridge with Remover/Installer C-4124. Squeeze the tool handles to complete the tightening of the clamp (Fig. 8). **Care must be exercised when using the tool to avoid cutting through the clamp bridge or damaging the boot.**

(5) Position the large-diameter end of the boot on the C/V joint housing.

(6) After the inner joint boot small clamp is installed, the inboard hub must be set to a service build length.

(a) Compress the inner hub down the connector shaft.

(b) Use a small blunt drift between the large end and the boot seal to relieve the pressure.

(c) The distance edge of the lip to the edge of the flange should be 181.00 mm (7.13 in.). This will eliminate excess air that can cause a ballooning affect and possibly cause damage to the boot.

REMOVAL AND INSTALLATION (Continued)

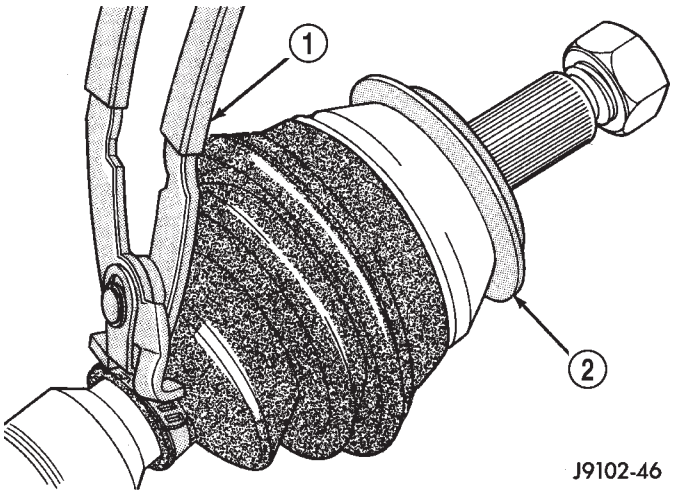


Fig. 8 Compressing Clamp Bridge

1 – TOOL C-4124
2 – SLINGER

(7) Verify that the boot is not twisted and that it is correctly positioned on the housing.

(8) Install the large ladder clamp on the boot and secure as done with the small ladder clamps (Fig. 8).

(9) Slide the outer C/V joint boot small clamp onto shaft.

(10) Slide outer C/V joint boot onto shaft and into position on shaft.

(11) Install small clamp to boot as done above.

(12) Install large boot clamp over outer C/V joint.

(13) Install outer C/V joint to shaft.

(14) Install large boot clamp to boot and C/V joint.

(15) Install the C/V driveshaft.

DISASSEMBLY AND ASSEMBLY

INNER C/V JOINT

DISASSEMBLY

(1) Remove the axle driveshaft.

(2) Place the inner C/V joint housing in a vise.

(3) Remove the inner boot retaining clamps. Pull the inner boot back onto the interconnecting shaft. Discard the retaining clamps.

(4) Pull the tripod and shaft straight out from the inner C/V joint housing.

(5) Remove the snap retaining ring from the groove behind the tripod (Fig. 9). Slide the tripod toward the center of the shaft. Remove the C-clip on the outer end of the shaft (Fig. 10).

(6) Remove the tripod from the shaft. Replace the boot, if necessary.

(7) Remove the lubricant from the interior of the housing and from the tripod.

(8) Inspect the needle bearing raceways in the housing and tripod components for excessive wear and damage. Replace the tripod as a unit only if necessary.

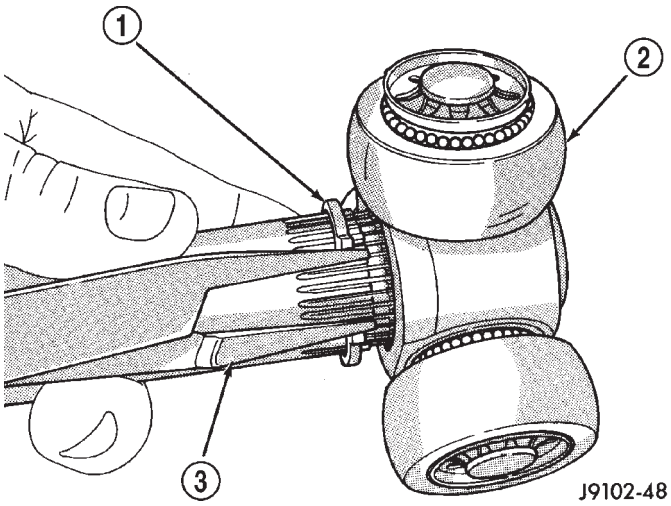


Fig. 9 Snap Retaining Ring Removal

1 – SNAP RING
2 – TRIPOD JOINT
3 – SNAP RING PLIERS

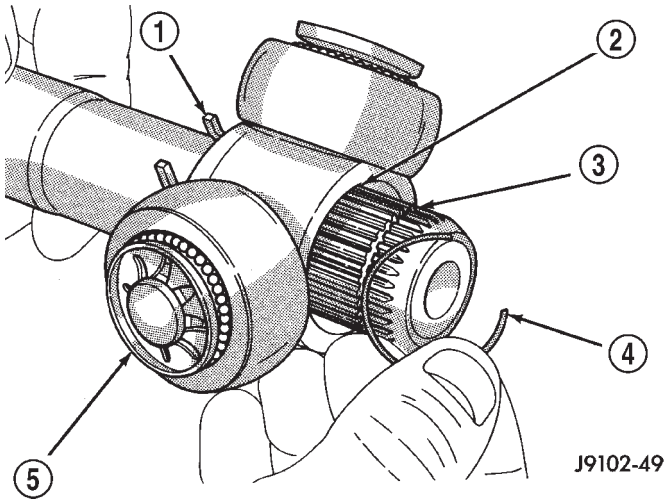


Fig. 10 C-Clip Removal/Installation

1 – SNAP RING
2 – CHAMFERED EDGE
3 – C-CLIP GROOVE
4 – C-CLIP
5 – TRIPOD

ASSEMBLY

(1) Slide the boot down enough for work access.

(2) Install the snap ring past the ring groove (toward the center of the shaft). Slide the tripod onto the end of the interconnecting shaft. Be sure the chamfered end of the tripod is adjacent to the C-clip retaining ring groove (Fig. 10).

(3) Install the C-clip in the groove. Slide the tripod out against the clip. Install the snap ring in the inner groove. Be sure the snap ring and C-clip are seated.

(4) Apply the required quantity of lubricant to the housing and boot. Coat the interior of the joint housing and the tripod.

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Insert and seat the tripod and shaft in the housing.

(6) Position the large-diameter end of the inner C/V joint boot over the edge of the housing. Insert the lip of the boot into the locating groove at the edge of the housing (Fig. 11).

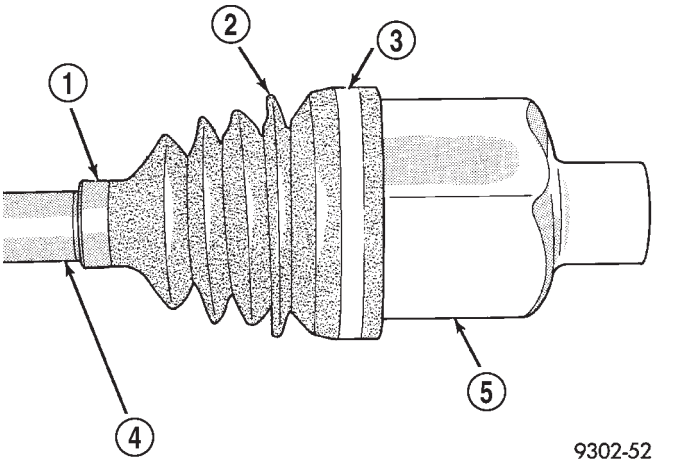


Fig. 11 Inner C/V Joint Boot

1 – SMALL CLAMP
2 – SEALING BOOT
3 – LARGE CLAMP
4 – INTERCONNECTING SHAFT
5 – INNER TRIPOD JOINT

(7) Insert the small lip into the locating groove in the interconnecting shaft.

(8) Retain the small–diameter of the boot on the shaft with a ladder-type clamp in the boot groove. Verify that the boot and lip are properly positioned on the intermediate shaft. Position the clamp locating tabs in the slots and tighten the clamp.

(9) Compress the clamp bridge with Remover/Installer C-4124. Squeeze the tool handles to complete the tightening of the clamp (Fig. 12). **Care must be exercised when using the tool to avoid cutting through the clamp bridge or damaging the boot.**

(10) Position the large-diameter end of the boot on the C/V joint housing.

(11) After the inner joint boot small clamp is installed, the inboard hub must be set to a service build length.

(a) Compress the inner hub down the connector shaft.

(b) Use a small blunt drift between the large end and the boot seal to relieve the pressure.

(c) The distance edge of the lip to the edge of the flange should be 181.00 mm (7.13 in.). This will eliminate excess air that can cause a ballooning affect and possibly cause damage to the boot.

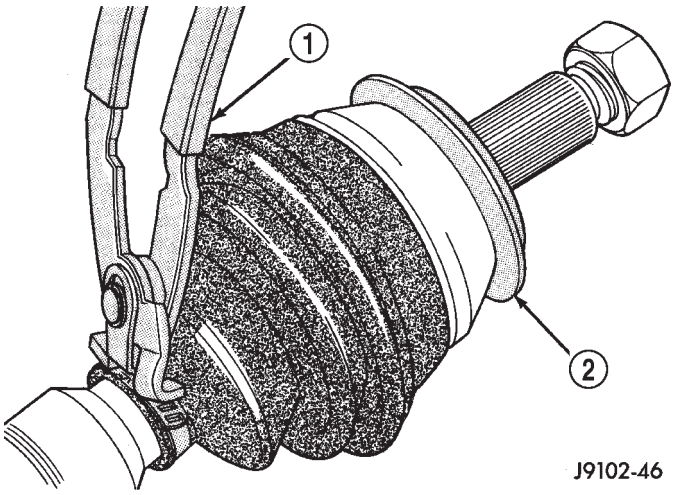


Fig. 12 Compressing Clamp Bridge

1 – TOOL C-4124
2 – SLINGER

(12) Verify that the boot is not twisted and that it is correctly positioned on the housing.

(13) Install the large ladder clamp on the boot and secure as done with the small ladder clamp (Fig. 12).

OUTER C/V JOINT

If the outer C/V joint is excessively worn, replace the entire C/V joint and boot.

DISASSEMBLY

(1) Remove retaining clamps from the outer C/V joint and discard. Slide the boot off the outer joint and down the shaft.

(2) Remove the lubricant to expose the outer C/V joint components (Fig. 13).

(3) Clamp the shaft in a vise (with soft jaws). Support the outer C/V joint.

(4) Use snap ring pliers to release the clip from the groove.

(5) Slide the outer C/V joint from the shaft (Fig. 14).

(6) Remove the slinger, if damaged, from the outer C/V joint. Use a brass drift and a hammer. Tap slinger ring off C/V joint and discard.

(7) Remove the old lubricant. Apply installation alignment marks on the bearing hub, bearing cage and housing with dabs of paint (Fig. 15).

(8) Clamp the outer C/V joint in a vertical position. Place the stub shaft in a soft–jawed vise.

DISASSEMBLY AND ASSEMBLY (Continued)

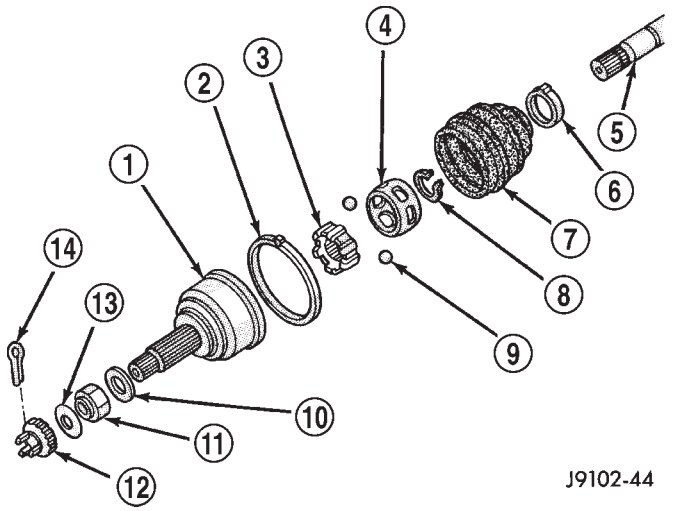


Fig. 13 Outer C/V Joint Components

1 – RZEPPA JOINT HOUSING (OUTER)
2 – CLAMP
3 – BEARING HUB
4 – BEARING CAGE
5 – SHAFT
6 – CLAMP
7 – BOOT
8 – SNAP RING
9 – BALLS (6)
10 – WASHER
11 – HUB NUT
12 – NUT LOCK
13 – SPRING WASHER
14 – COTTER PIN

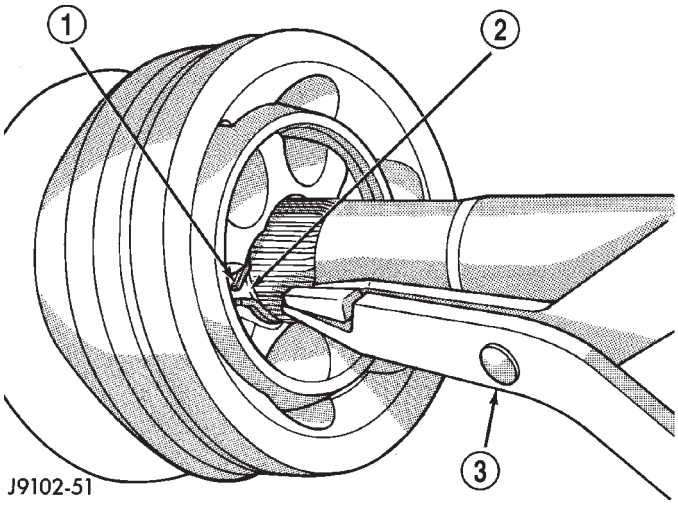


Fig. 14 Outer C/V Joint Removal

1 – SNAP RING
2 – SNAP RING GROOVE
3 – SNAP RING PLIERS

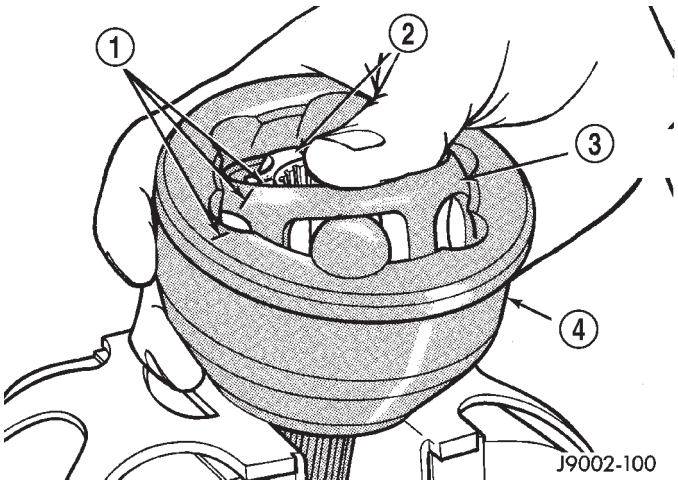


Fig. 15 Ball Access

1 – INSTALLATION ALIGNMENT MARKS
2 – BEARING HUB
3 – BEARING CAGE
4 – CV JOINT HOUSING (OUTER)

(9) Press down on one side of the bearing cage/hub to tilt the cage. This will provide access to a ball at the opposite side of the cage. If the C/V joint is tight, use a hammer and brass drift to loosen the bearing hub. **Do not contact the bearing cage with the drift.**

(10) Remove the ball from the bearing cage (Fig. 16). If necessary, a small pry bar can be used to pry the ball loose from the cage.

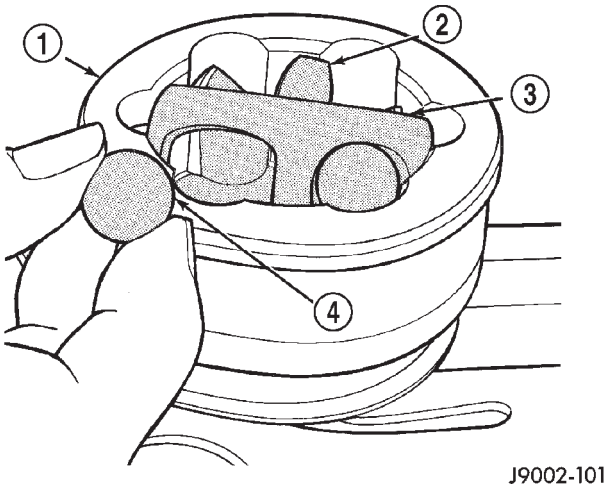


Fig. 16 Ball Removal

1 – CV JOINT HOUSING (OUTER)
2 – BEARING HUB (UP)
3 – BEARING CAGE (UP)
4 – BALL

(11) Repeat the step above until all six balls are removed from the bearing cage.

DISASSEMBLY AND ASSEMBLY (Continued)

(12) Tilt the bearing cage and hub to a vertical position. Remove the cage from the housing. Pull cage upward and away from the housing (Fig. 17).

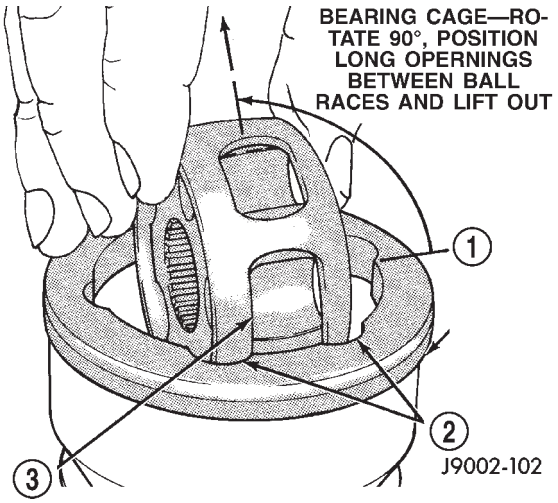


Fig. 17 Bearing Cage & Hub Removal

1 – CV JOINT HOUSING (OUTER)
2 – BALL RACE
3 – BEARING CAGE WINDOW

(13) Turn the bearing hub 90° from the bearing cage. Align one pair of the hub lands with the cage windows. Raise and insert one of the lands into the adjacent cage window. Remove the bearing hub by rolling it out of the cage (Fig. 18).

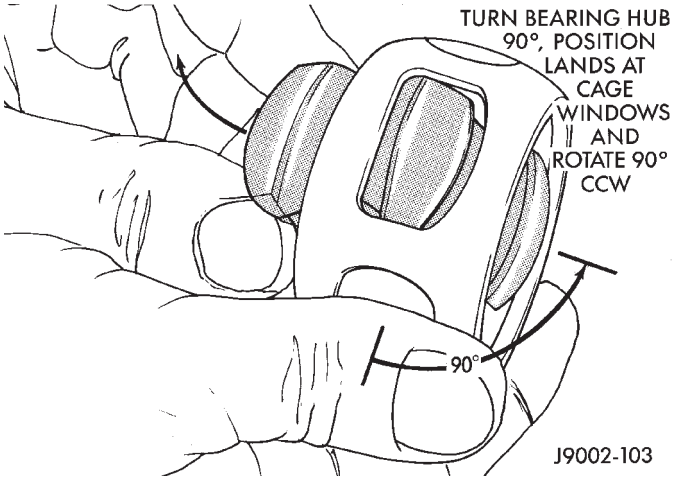


Fig. 18 Bearing Hub Removal

ASSEMBLY

(1) Lightly apply lubricating oil to all the outer C/V joint components before assembling them.

(2) Align the bearing hub, cage and housing (Fig. 15) according to the alignment reference marks.

(3) Insert one of the bearing hub lands into a bearing cage window (Fig. 18). Roll the hub into the cage (Fig. 19). Rotate the bearing hub 90° to complete the installation (Fig. 20).

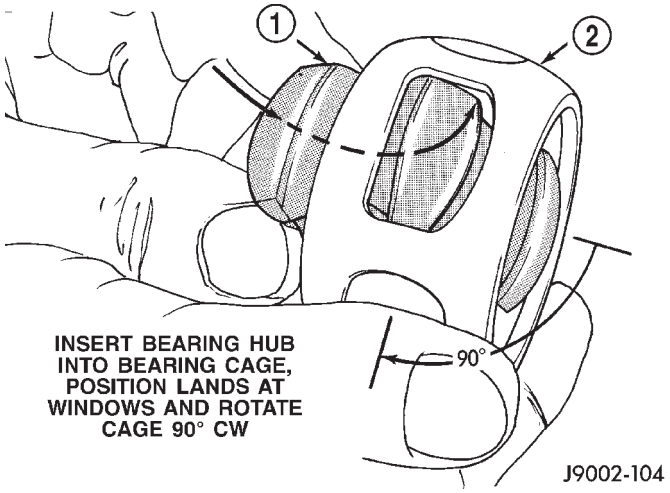


Fig. 19 Bearing Hub Installation

1 – BEARING HUB
2 – BEARING CAGE

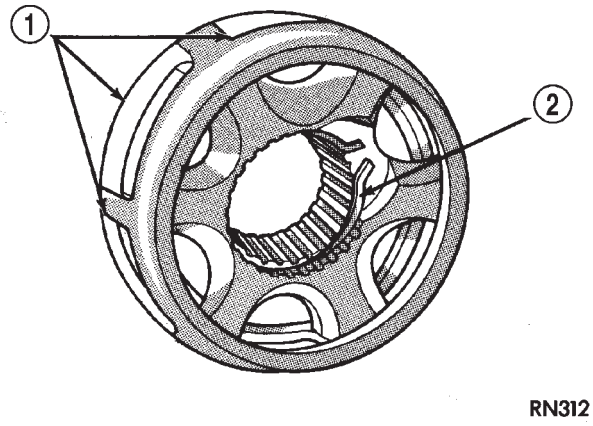


Fig. 20 Assembled Bearing Cage & Hub

1 – CAGE WINDOWS
2 – CIRCLIP RETAINER

(4) Insert bearing cage/hub into the housing (Fig. 21). Rotate the cage/hub 90° to complete the installation (Fig. 22).

(5) Apply the lubricant included with the replacement boot to the ball raceways. Spread the lubricant equally between all the raceways. One packet of lubricant is sufficient to lubricate the complete C/V joint.

(6) Tilt the bearing hub and cage and install the balls in the raceways (Fig. 23).

DISASSEMBLY AND ASSEMBLY (Continued)

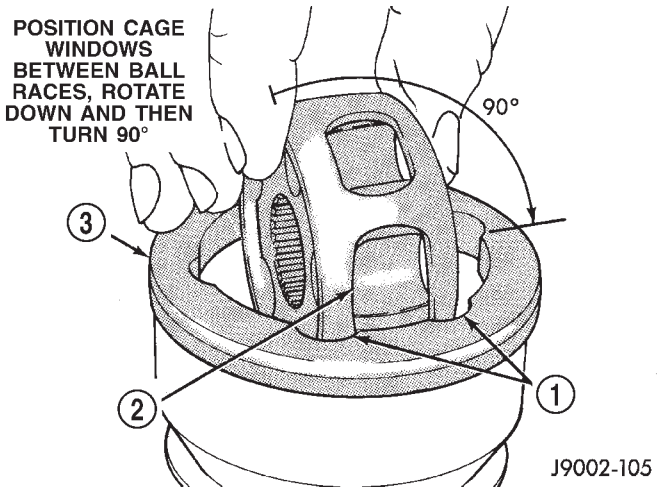


Fig. 21 Bearing Cage & Hub Installation

1 – BALL RACE
2 – BEARING CAGE WINDOW
3 – CV JOINT HOUSING (OUTER)

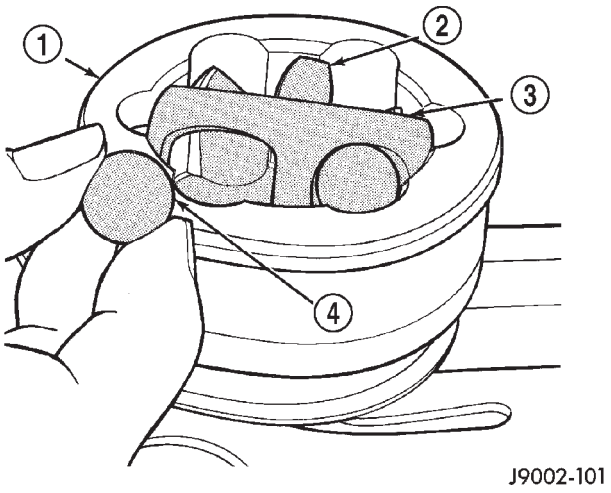


Fig. 23 Ball Installation In Raceway

1 – CV JOINT HOUSING (OUTER)
2 – BEARING HUB (UP)
3 – BEARING CAGE (UP)
4 – BALL

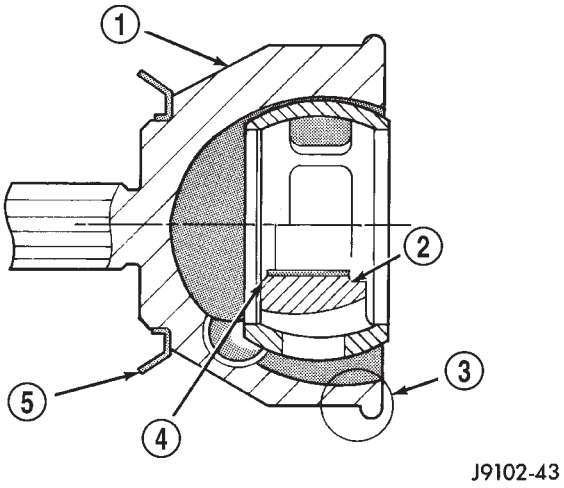


Fig. 22 Bearing Cage & Hub Installed In Housing

1 – CV JOINT HOUSING (OUTER)
2 – BEARING HUB LARGE COUNTERBORE OUTWARD
3 – BOOT RETAINING SHOULDER
4 – BEARING HUB SMALL COUNTERBORE INWARD
5 – SLINGER

(7) Apply a small amount of lubricant to inner diameter of slinger. Place slinger squarely on the outer C/V joint. Use installer tool L-4518-1 from tool set L-4518 and hammer slinger onto joint until it seats (Fig. 24).

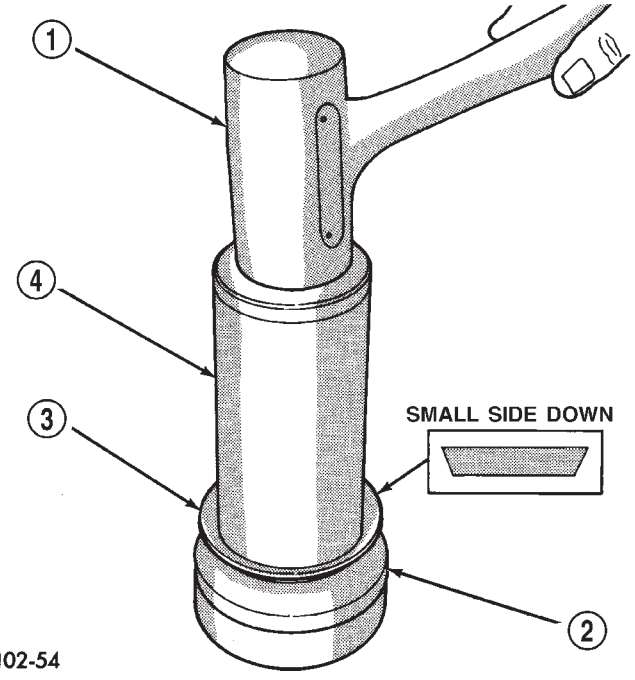


Fig. 24 Slinger Installation

1 – HAMMER
2 – OUTER C. V. JOINT
3 – SLINGER
4 – SPECIAL TOOL L-4518–1

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Prevent damage to the slinger after installation or a when a replacement outer C/V joint is installed.

(8) Position the small-diameter end of the replacement boot on the interconnecting shaft. Retain the boot with a replacement clamp.

(9) Apply the required amount of lubricant to the outer C/V joint and boot.

(10) Align the shaft splines to the outer C/V joint splines. Push the outer C/V joint until the snap ring seats in the groove (Fig. 25).

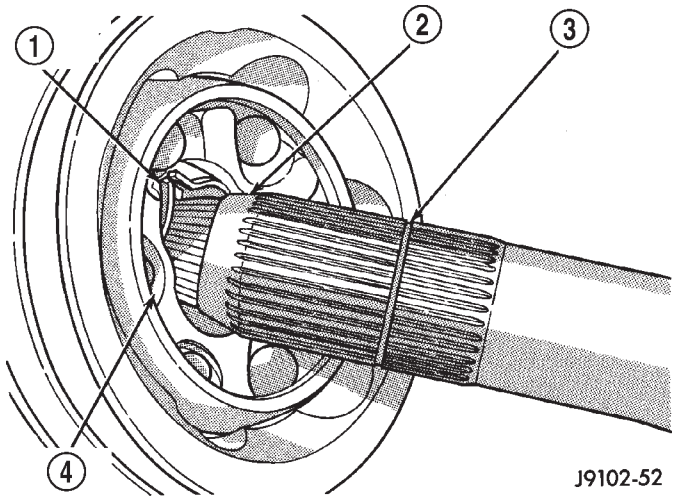


Fig. 25 Outer C/V Joint Installation

1 – SNAP RING
2 – SHAFT TAPER
3 – SNAP RING GROOVE
4 – BEARING HUB

(11) Ensure that the snap ring is properly seated in the housing. Pull the outer C/V joint from the interconnecting shaft to test.

(12) Place the large-diameter end of the replacement boot over the edge of the C/V joint housing. Ensure that the boot is not twisted.

(13) Retain the boot on the housing with a replacement retaining clamps.

CLEANING AND INSPECTION

C/V JOINT

Inspect the lubricant for contamination. Inspect the C/V joint components for defects according to the following instructions.

(1) Clean all the components with an appropriate solvent and dry them with compressed air.

(2) Inspect the ball raceways in the housing for excessive wear and scoring.

(3) Examine the stub shaft splines and threads for damage.

(4) Inspect the balls for pitting, cracks, scoring and excessive wear. A dull exterior surface is normal.

(5) Inspect the bearing cage for wear, grooves, ripples, cracks and chipping.

(6) Inspect the bearing hub (Fig. 26) for excessive wear and scoring on ball raceways.

Polished contact surface areas on the raceways and on the bearing cage spheres are normal. If the joints cause a noise or a vibration, replace them.

CLEANING AND INSPECTION (Continued)

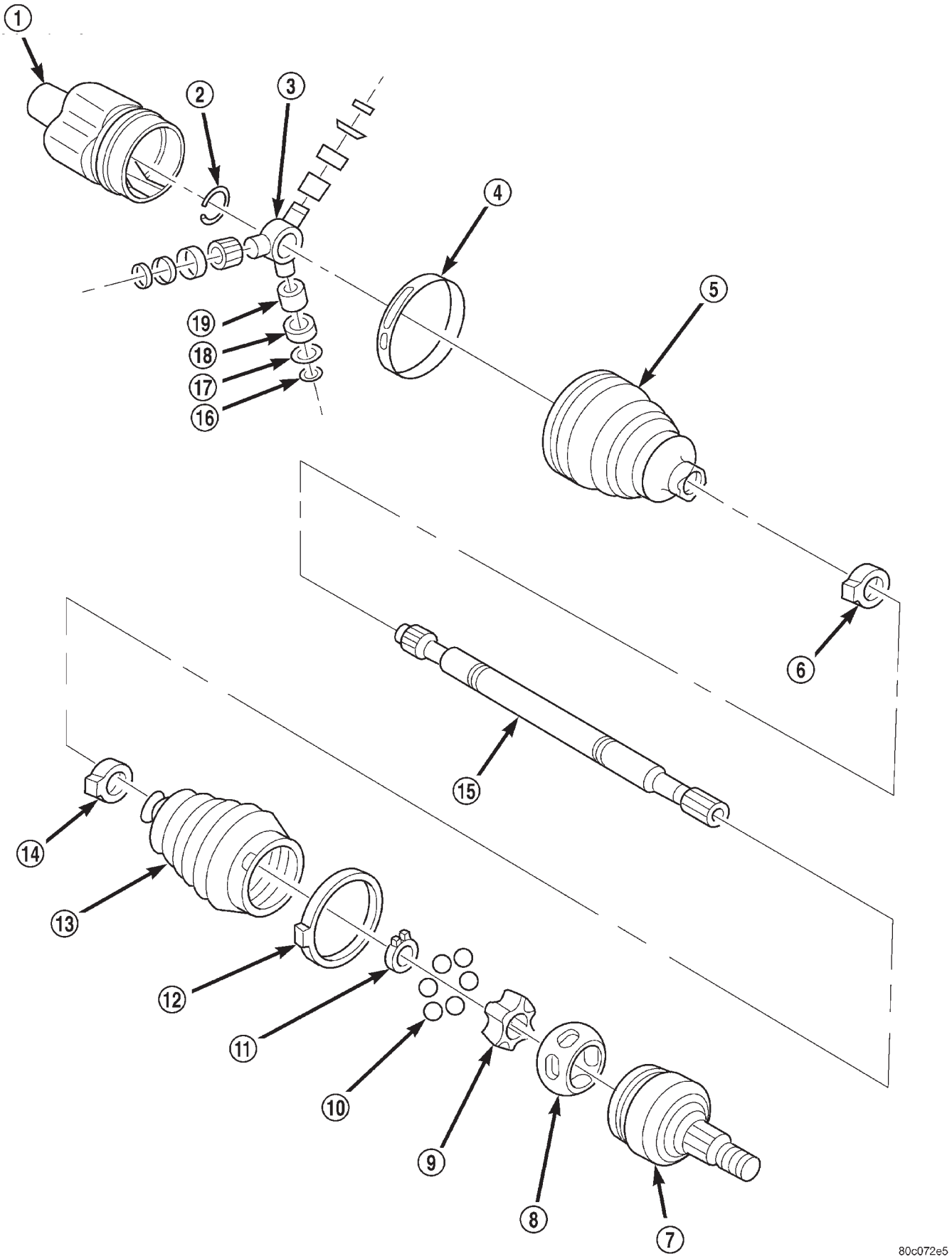


Fig. 26 Drive Shaft Components

CLEANING AND INSPECTION (Continued)

1 – RETAINER & HOUSING ASM
2 – C-CLIP
3 – TRIPOD JOINT SPIDER
4 – SEAL RETAINING CLAMP
5 – INNER BOOT
6 – SEAL RETAINING CLAMP
7 – C/V JOINT OUTER RACE
8 – C/V JOINT CAGE
9 – C/V JOINT INNER RACE
10 – CHROME ALLOY BALL
11 – RACE RETAINING RING
12 – SEAL RETAINING CLAMP
13 – DRIVE AXLE OUTBOARD SEAL
14 – SEAL RETAINING CLAMP
15 – AXLE SHAFT
16 – RETAINING RING
17 – BALL & ROLLER RETAINER
18 – TRIPOD JOINT BALL
19 – NEEDLE ROLLER

C/V JOINT BOOTS

Look for lubricant around the exterior of a boot. When a C/V drive shaft is removed from the vehicle for service, the boot should be properly cleaned. Inspect for cracks, tears and scuffed areas on the surfaces. If any of these conditions exist, boot replacement is recommended.

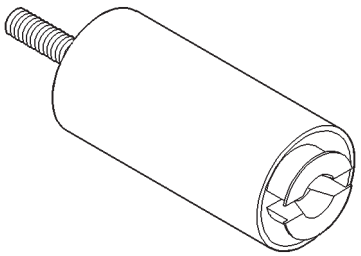
SPECIFICATIONS

TORQUE

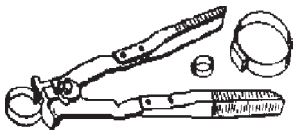
DESCRIPTION	TORQUE
Bolts, Axle Flange	90 N·m (65 ft. lbs.)
Nut, Axle	244 N·m (180 ft. lbs.)

SPECIAL TOOLS

C/V JOINT DRIVESHAFT



Tool Set—L-4518



Remover/Installer—C-4124

C205F AXLE

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DESCRIPTION AND OPERATION

C205F AXLE

DESCRIPTION

The C205F (**C** orporate **205** mm ring gear **F** ront) axle consists of an alumunum center section with an axle tube extending from one side. The tube is pressed into the differential housing.

The integral type housing, hypoid gear design has the centerline of the pinion set below the centerline of the ring gear.

The axle has a fitting for a vent hose used to relieve internal pressure caused by vaporization and internal expansion.

The power is transferred from the axle through two constant velocity (C/V) drive shafts to the wheel hubs. The drive shafts are identical and interchangeable.

The cover provides a means for inspection and service without removing the axle from the vehicle.

The C205F axle has the assembly date and gear ratio listed on a tag. The tag is attached to the housing cover by a cover bolt.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a roll-pin. Differential bearing preload and ring gear backlash is adjusted by the use of shims (select thickness). The shims are located between the differential bearing cups and the axle housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

OPERATION

The axle receives power from the transfer case through the front propeller shaft. The front propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

LUBRICANT

DESCRIPTION

A multi–purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL–L–2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W–90 gear lubricant.

The C205F axle lubricant capacity is 1.66 L (3.5 pts.).

DESCRIPTION AND OPERATION (Continued)

CAUTION: If axle is submerged in water, lubricant must be replaced immediately to avoid possible premature axle failure.

STANDARD DIFFERENTIAL

DESCRIPTION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

OPERATION

In operation, power flow occurs as follows:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (splined to the axle shafts) rotate the shafts

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 1).

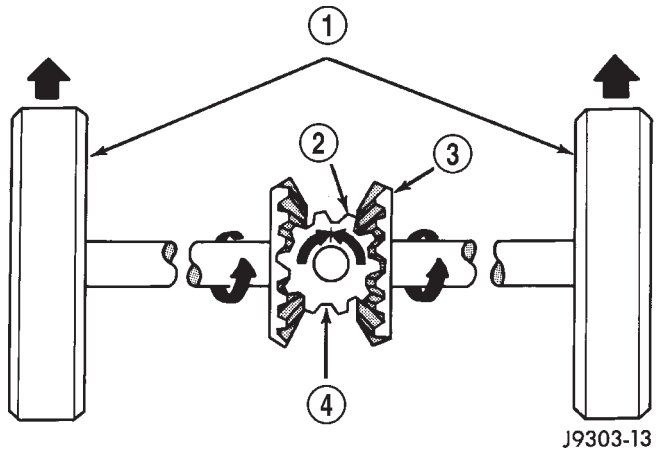

Fig. 1 Differential Operation—Straight Ahead Driving

1 – IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 – PINION GEAR
3 – SIDE GEAR
4 – PINION GEARS ROTATE WITH CASE

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

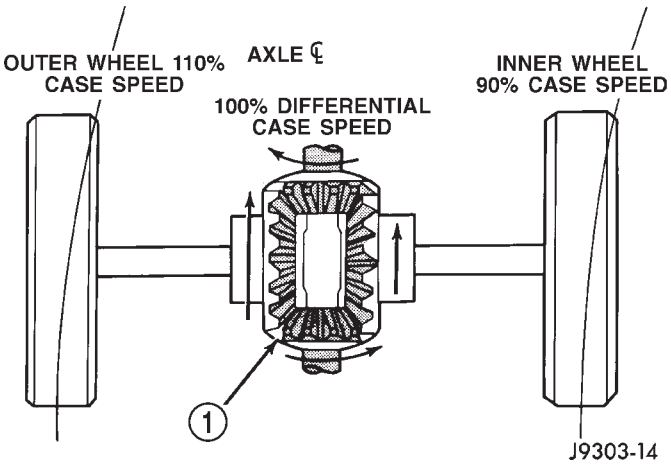

Fig. 2 Differential Operation—On Turns

1 – PINION GEARS ROTATE ON PINION SHAFT

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:

- Insufficient or incorrect lubricant.
- Foreign matter/water contamination.
- Incorrect bearing preload torque adjustment.
- Incorrect backlash.

Axle gear problem conditions are usually the result of:

- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.

Axle component breakage is most often the result of:

- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.
- Differential housing bores not square to each other.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion companion flange nut.	6. Tighten the pinion companion flange nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Causes	Correction
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored companion flange.	5. Replace companion flange and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Causes	Correction
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak–noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant–pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the front pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the rear pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U–joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out–of–balance wheels.
- Loose wheel lug nuts.
- Worn U–joint(s).
- Loose/broken springs.

DIAGNOSIS AND TESTING (Continued)

- Damaged axle shaft bearing(s).
- Loose pinion nut.
- Excessive companion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front–end components or engine/transmission mounts. These components can contribute to what appears to be a rear–end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires, for additional vibration information.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U–joints.
- Loose spring mounts.
- Loose pinion nut and companion flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

SERVICE PROCEDURES

LUBRICANT CHANGE

(1) Raise and support the vehicle.

(2) Remove the lubricant fill hole plug from the differential housing cover.

(3) Remove the differential housing cover and drain the lubricant from the housing.

(4) Clean the housing cavity with a flushing oil, light engine oil or lint free cloth. **Do not use water, steam, kerosene or gasoline for cleaning.**

(5) Remove the sealant from the housing and cover surfaces. Use solvent to clean the mating surfaces.

(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 3).

Install the housing cover within 5 minutes after applying the sealant.

(7) Install the cover and any identification tag. Tighten the cover bolts in a criss–cross pattern to 41 N·m (30 ft. lbs.) torque.

(8) Refill the differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications in this group for the quantity necessary.

(9) Install the fill hole plug and lower the vehicle. Tighten fill plug to 34 N·m (25 ft. lbs.).

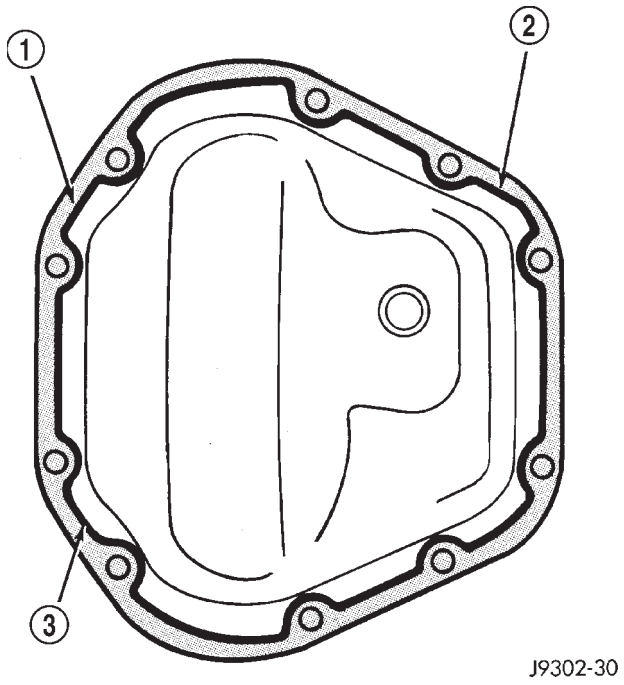

Fig. 3 Typical Housing Cover With Sealant

1 – SEALING SURFACE
2 – CONTOUR OF BEAD
3 – BEAD THICKNESS 6.35MM (1/4")

REMOVAL AND INSTALLATION

FRONT AXLE

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the skid plate, if equipped.

(3) Remove skid plate support crossmember, if necessary.

(4) Remove both C/V driveshafts.

(5) Mark the propeller shaft, transfer case, and pinion companion flange for installation alignment reference.

(6) Remove the front propeller shaft.

(7) Remove the axle vent tube.

(8) Use an adjustable and movable jack to support the differential housing.

(9) Remove bolts holding the axle to the engine mounts (Fig. 4).

(10) Remove bolts holding the axle to the pinion nose bracket (Fig. 5).

(11) Lower the jack and housing.

(12) Remove the axle from vehicle.

REMOVAL AND INSTALLATION (Continued)

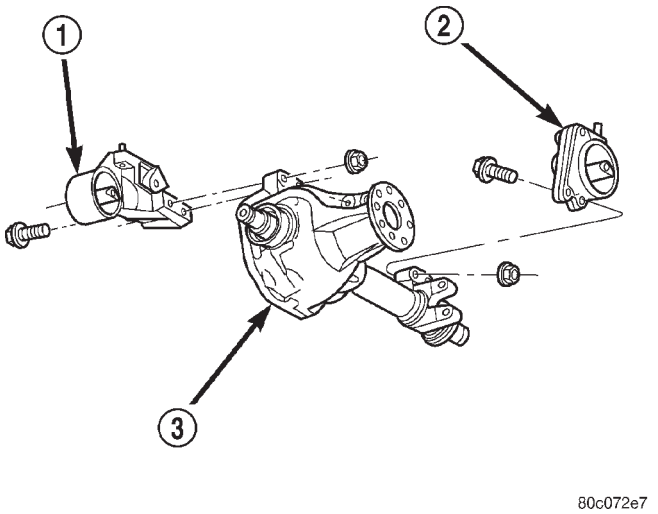

Fig. 4 Axle to Engine Mounts Mounting

1 – LEFT ENGINE MOUNT
2 – RIGHT ENGINE MOUNT
3 – FRONT AXLE

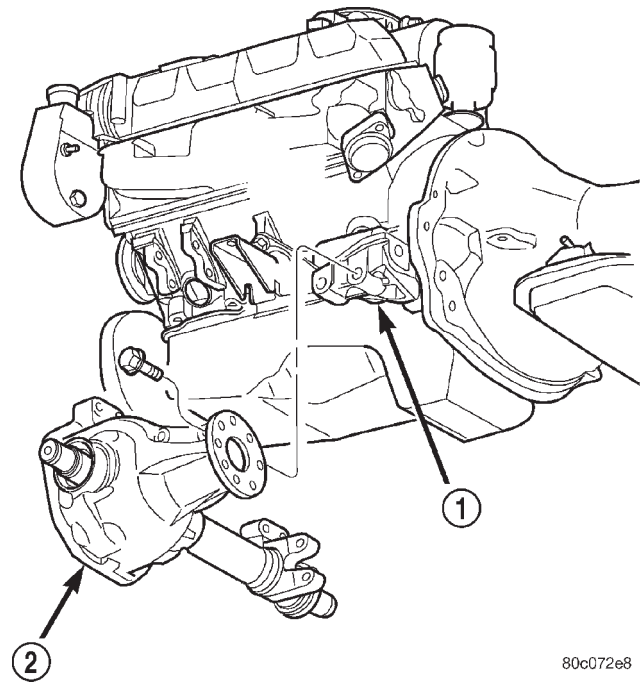

Fig. 5 Pinion Nose Bracket Mounting

1 – PINION NOSE BRACKET
2 – FRONT AXLE

INSTALLATION

(1) Raise the axle into position. Loosely install the bolts and nuts to hold the axle to the engine mounts and pinion nose bracket.

(2) Tighten all the bolts finger-tight, then tighten all bolts to 95 N·m (70 ft. lbs.).

(3) Install the axle vent tube.

(4) Align the reference marks on the propeller shaft, transfer case, and pinion companion flange.

(5) Install propeller shaft.

(6) Install the C/V driveshafts.

(7) Install the skid plate support crossmember, if necessary.

(8) Install the skid plate, if necessary.

(9) Check differential lubricant level and add lubricant, if necessary. Refer to Lubricant Specifications in this group for lubricant requirements.

(10) Remove the supports and lower the vehicle.

PINION SHAFT SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove skid plate, if equipped.

(3) Remove both C/V driveshafts.

(4) Mark the propeller shaft and pinion companion flange for installation alignment reference.

(5) Remove the front propeller shaft.

(6) Rotate the pinion gear three or four times.

(7) Measure the amount of torque necessary to rotate the pinion with a (in. lbs.) dial-type torque wrench (Fig. 6). Record the torque reading for installation reference.

(8) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(9) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(10) Hold the flange with Holder 6719. Remove the pinion nut.

(11) Remove the companion flange with Remover C-452 (Fig. 7).

(12) Using a suitable pry tool, or a slide hammer mounted screw, remove the pinion seal.

INSTALLATION

(1) Clean the seal contact surface in the housing bore.

(2) Examine the splines on the pinion shaft for burrs or wear. Remove any burrs and clean the shaft.

(3) Inspect companion flange for cracks, worn splines and worn seal contact surface. Replace companion flange if necessary.

NOTE: The outer perimeter of the seal is pre-coated with a special sealant. An additional application of sealant is not required.

REMOVAL AND INSTALLATION (Continued)

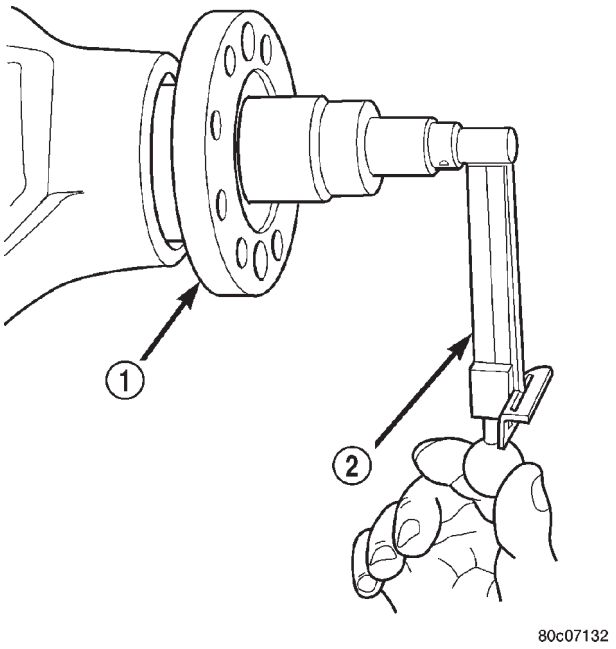

Fig. 6 Measure Total Axle Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

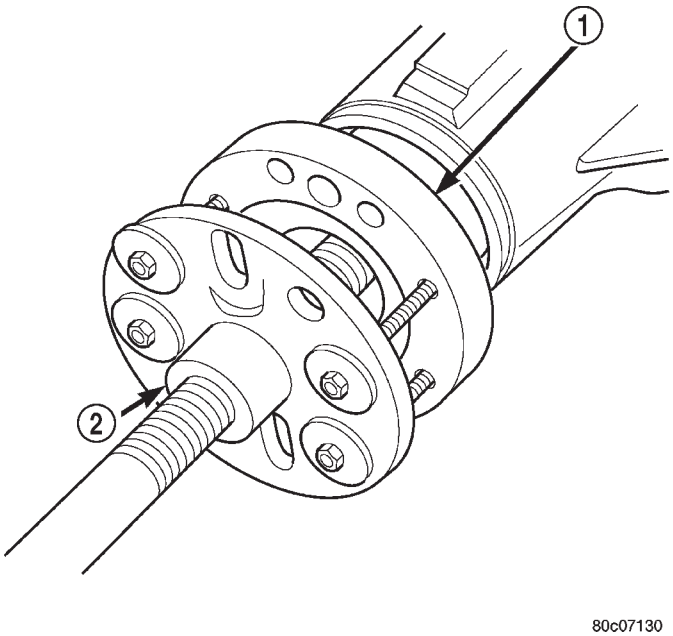

Fig. 7 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

(4) Apply a light coating of gear lubricant on the lip of pinion seal.

(5) Install seal with Installer C-3972-A and Handle C–4171 (Fig. 8).

(6) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

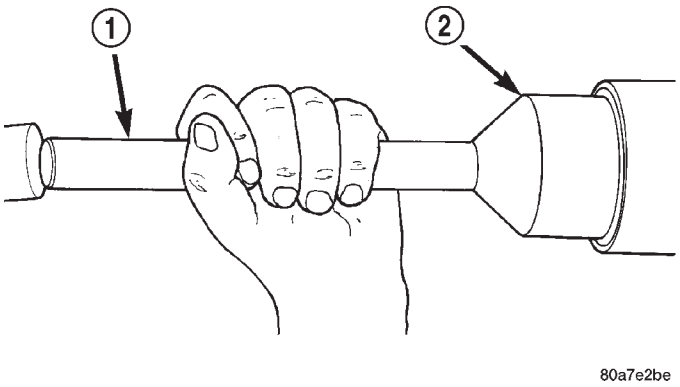

Fig. 8 Pinion Seal Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3972–A

(7) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(8) Install the companion flange onto the pinion with Installer C-3718 and Holder 6719.

CAUTION: Do not exceed the minimum tightening torque when installing the companion flange at this point. Damage to the collapsible spacer or bearings may result.

(9) Install the new pinion nut onto the pinion shaft and tighten the pinion nut until there is zero bearing end-play (Fig. 9).

(10) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(11) Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.) (Fig. 10).

(12) If the rotating torque is low, use Holder 6719 to hold the companion flange, and tighten the pinion nut in 6.8 N·m (5 ft. lbs.) increments until the proper rotating torque is achieved.

CAUTION: If the maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

REMOVAL AND INSTALLATION (Continued)

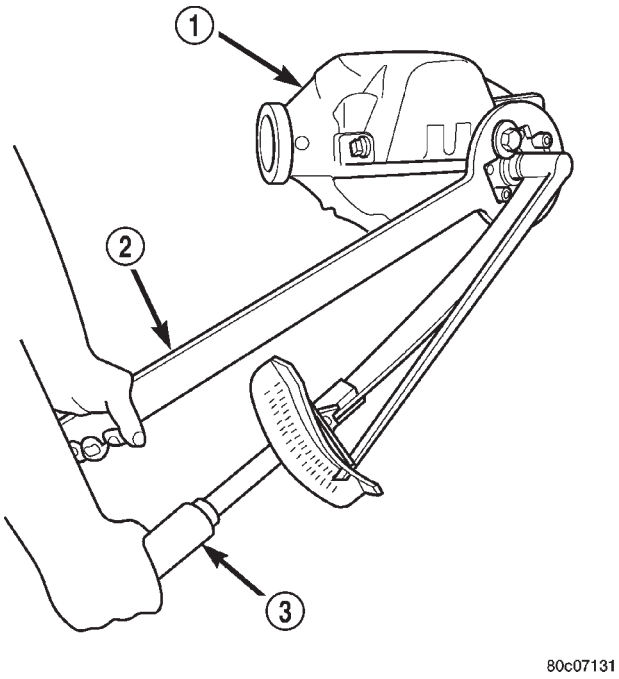

Fig. 9 Tighten Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

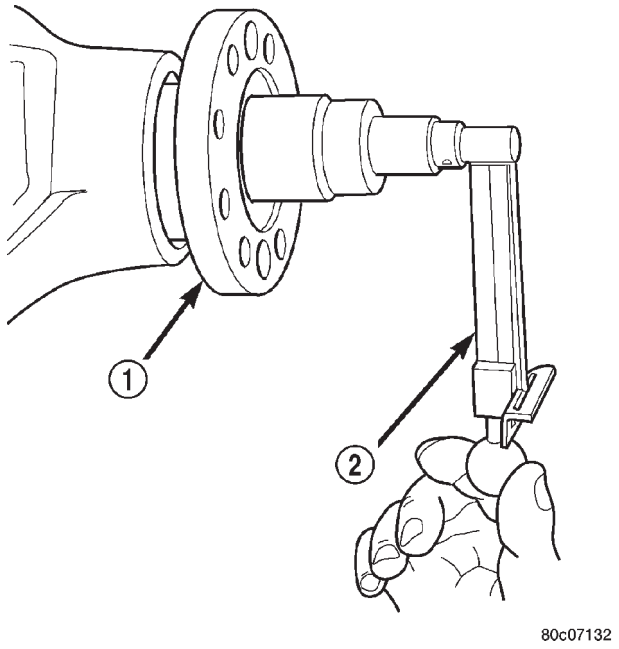

Fig. 10 Check Pinion Rotation Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

(13) Align the installation reference marks on the propeller shaft and companion flange and install the propeller shaft.

(14) Add gear lubricant to the differential housing, if necessary. Refer to the Lubricant Specifications for gear lubricant requirements.

(15) Install both C/V driveshafts.

(16) Install skid plate, if equipped.

(17) Lower the vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.

(2) Remove the necessary C/V driveshaft from vehicle.

(3) Remove the skid plate, if equipped.

(4) Clean all foreign material from axle seal area.

(5) Install Puller Adapter 8420 onto the axle shaft.

(6) Install Slide Hammer C-3752 to the puller adapter.

(7) Remove axle shaft. Use care to prevent damage to axle shaft bearing and seal, which will remain in axle shaft tube.

(8) Inspect axle shaft seal for leakage or damage. Replace the seal if there is any question as to its condition.

(9) Inspect roller bearing contact surface on axle shaft for signs of brinelling, galling and pitting. If any of these conditions exist, the axle shaft and/or bearing and seal must be replaced.

INSTALLATION

(1) Lubricate bearing bore and seal lip with gear lubricant. Insert axle shaft through seal, bearing, and engage it into side gear splines.

NOTE: Use care to prevent shaft splines from damaging axle shaft seal lip.

(2) Push firmly on the axle shaft until the axle shaft snap-ring passes completely through the side gear and engages the snap-ring groove.

(3) Check the differential fluid level and add fluid if necessary. Refer to Lubricant in this group for lubricant requirements.

(4) Install skid plate, if necessary.

(5) Install C/V driveshaft.

(6) Lower vehicle.

AXLE SHAFT SEAL AND BEARING

REMOVAL

(1) Remove the axle shaft.

(2) Remove the axle shaft seal from the end of the axle shaft tube with a small pry bar.

NOTE: The seal and bearing can be removed at the same time with the bearing removal tool.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the axle shaft bearing from the axle tube with Bearing Removal Tool C-4660-A.

(4) Inspect the axle shaft tube bore for roughness and burrs. Remove as necessary.

INSTALLATION

Do not install the original axle shaft seal. Always install a new seal.

(1) Wipe the axle shaft tube bore clean.

(2) Install axle shaft bearing with Installer 5063 and Handle C–4171.

(3) Install the new axle shaft seal with Installer 8402 and Handle C–4171.

(4) Install the axle shaft.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.

(2) Remove the differential housing cover and allow fluid to drain.

(3) Remove the axle shafts.

(4) Note the installation reference numbers stamped on one of the bearing caps and a machined flat on the housing next to the sealing surface. If the reference numbers cannot be found or seen easily, make new marks for later reference.

(5) Loosen the differential bearing cap bolts.

(6) Install Adapter Plates 8142-A onto the axle housing.

(7) Position Spreader W–129–B onto the adapter plates and install the safety holddown clamps. Tighten the tool turnbuckle finger-tight.

(8) Install a Pilot Stud L-4438 at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Do not spread over 0.34 mm (0.013 in). If the housing is over–spread, it could be distorted or damaged.

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 11).

(10) Remove the dial indicator.

(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(12) Remove the differential from the housing. Ensure that the differential bearing cups and shims remain in position on the differential bearings.

(13) Mark or tag the differential bearing cups and shims to indicate which side of the differential they were removed from.

(14) Remove spreader from housing.

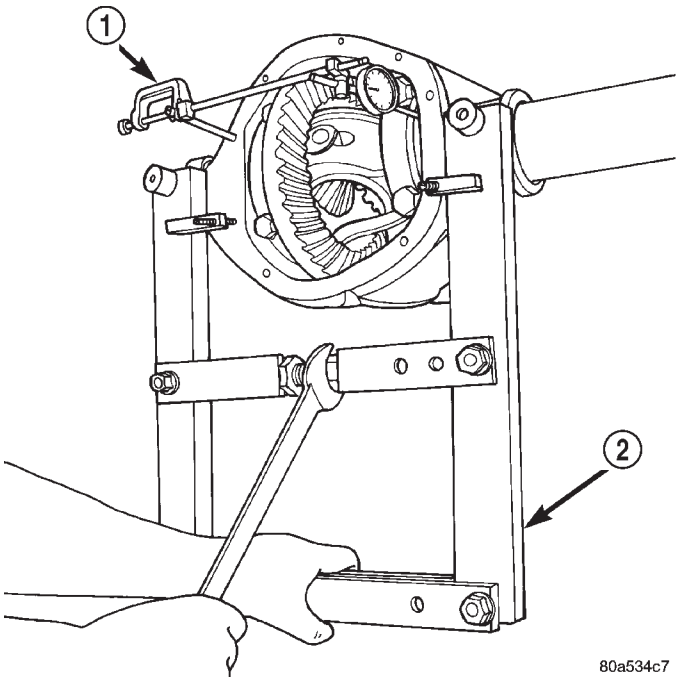

Fig. 11 Spread Axle Housing—Typical

1 – SPECIAL TOOL C-3339
2 – SPECIAL TOOL W-129–B

INSTALLATION

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Position Spreader W–129–B, with the Adapter Plates 8142-A seated in the locating holes, on the axle and install the safety holddown clamps. Tighten the tool turnbuckle finger–tight.

(2) Install a Pilot Stud C-4438 at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Do not spread over 0.34 mm (0.013 in). If the housing is over-spread, it could be distorted or damaged.

(3) Spread the housing enough to install the differential case and preload shims in the housing. Measure the distance with the dial indicator.

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings and the differential preload shims are seated in the housing. Tap the differential case to ensure the bearings cups are fully seated in the housing.

REMOVAL AND INSTALLATION (Continued)

(6) Install the bearing caps at their original locations.
(7) Loosely install differential bearing cap bolts.
(8) Remove axle housing spreader.
(9) Tighten the bearing cap bolts to 61 N·m (45 ft. lbs.) torque.
(10) Install the axle shafts.
(11) Install the differential housing cover and fill with the correct lubricant.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential from axle housing.
(2) Remove the bearings from the differential case with Puller/Press C-293-PA, C-293-48 Blocks, and Plug C-293-3 (Fig. 12).

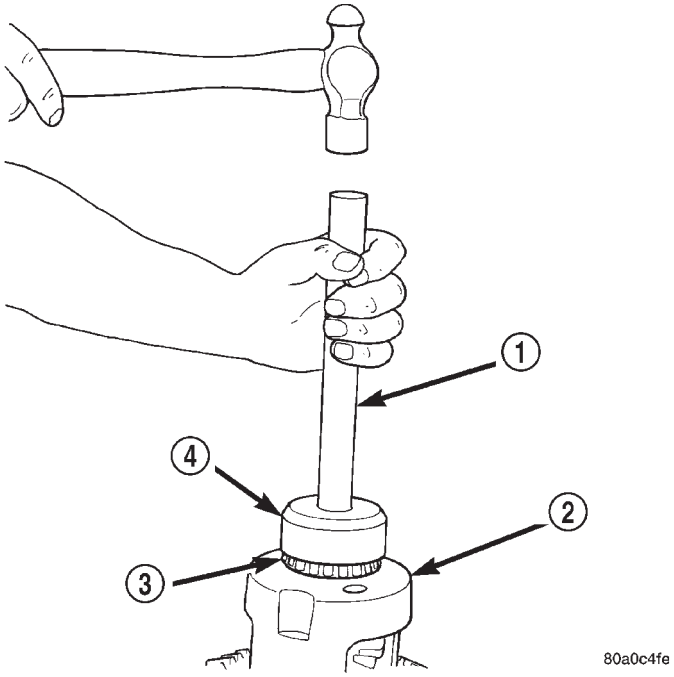

Fig. 12 Differential Bearing Removal

1 – HANDLE C-4171
2 – DIFFERENTIAL
3 – BEARING
4 – TOOL C-4340

INSTALLATION

(1) Using Installer 8236, with handle C-4171, install the differential side bearings (Fig. 13).
(2) Install differential in axle housing.

RING GEAR

NOTE: The ring gear and pinion are service in a matched set. Do not replace the ring gear without replacing the pinion.

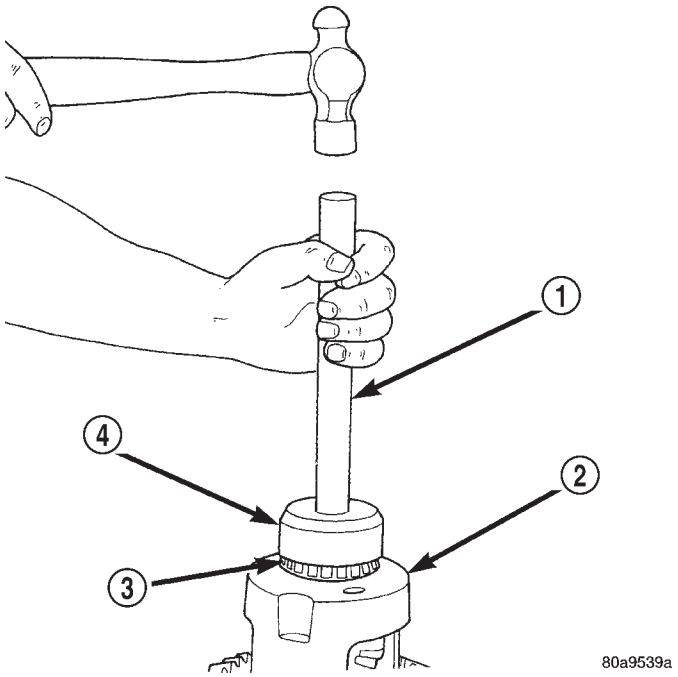

Fig. 13 Install Differential Side Bearings

1 – HANDLE C-4171
2 – DIFFERENTIAL
3 – BEARING
4 – TOOL C-3716–A

REMOVAL

(1) Remove differential from axle housing.
(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 14)
(3) Remove bolts holding ring gear to differential case.
(4) Using a soft hammer, drive ring gear from differential case (Fig. 14).

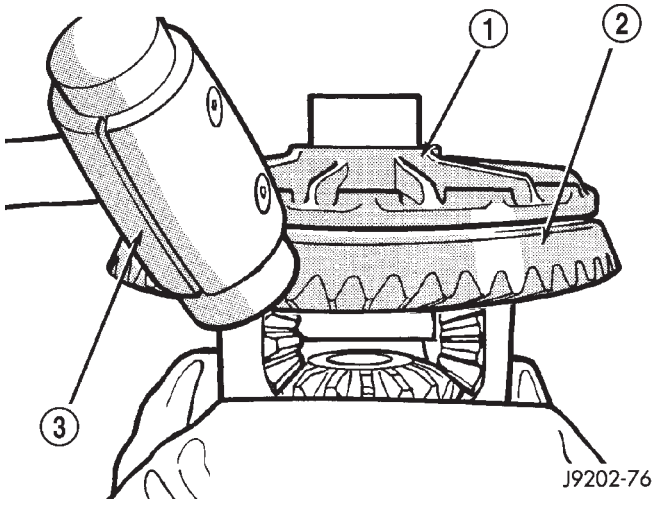

Fig. 14 Ring Gear Removal

1 – CASE
2 – RING GEAR
3 – RAWHIDE HAMMER

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

(1) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(2) Invert the differential case in the vise.

(3) Install new ring gear bolts and alternately tighten to 95–122 N·m (70–90 ft. lbs.) torque (Fig. 15).

(4) Install differential in axle housing and verify gear mesh and contact pattern.

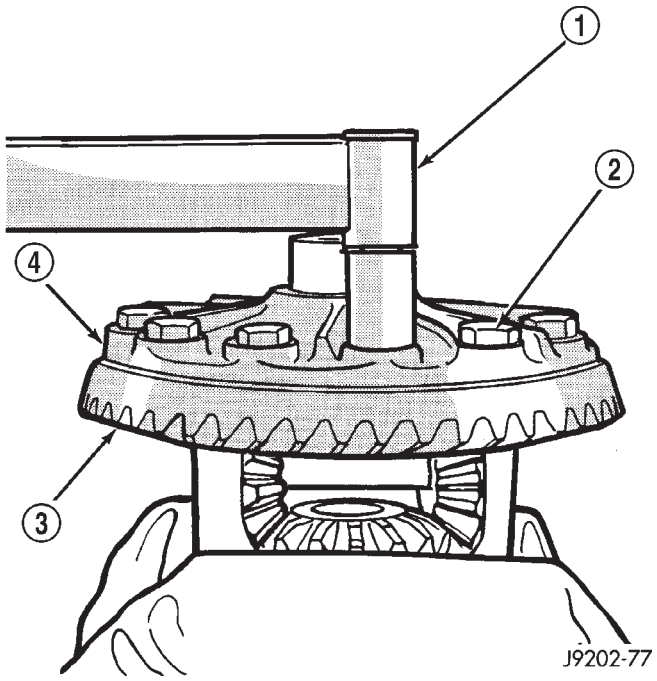

Fig. 15 Ring Gear Bolt Installation

1 – TORQUE WRENCH
2 – RING GEAR BOLT
3 – RING GEAR
4 – CASE

PINION GEAR

NOTE: The ring gear and pinion are serviced in a matched set. Do not replace the pinion without replacing the ring gear.

REMOVAL

(1) Remove differential from the axle housing.

(2) Mark the companion yoke and companion flange for installation alignment.

(3) Remove the bolts holding the companion yoke to the companion flange.

(4) Separate the propeller shaft from the companion flange and using suitable wire, tie the propeller shaft to the vehicle underbody.

(5) Rotate the pinion gear three or four times.

(6) Measure the amount of torque necessary to rotate the pinion with a (in. lbs.) dial-type torque wrench (Fig. 16). Record the torque reading for installation reference.

(7) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(8) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(9) Hold the flange with Holder 6719. Remove the pinion nut.

(10) Remove the companion flange with Remover C-452 (Fig. 17).

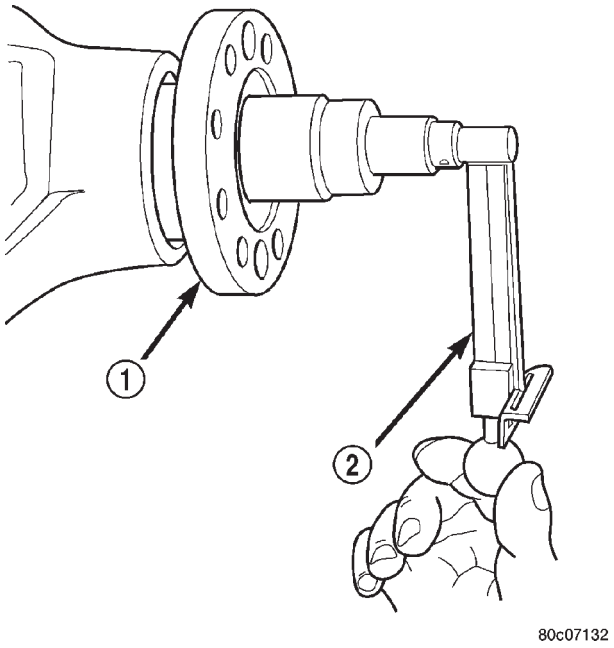

Fig. 16 Measure Pinion Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

REMOVAL AND INSTALLATION (Continued)

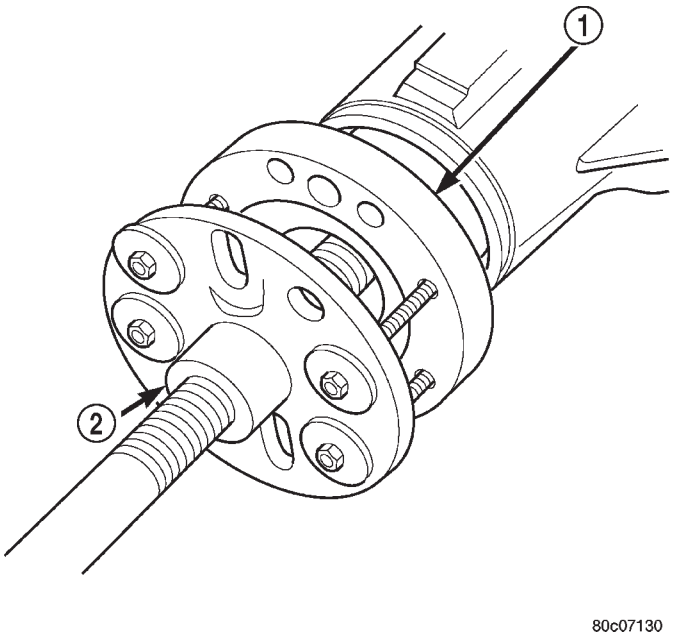

Fig. 17 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

(11) Remove the pinion from housing (Fig. 18). Catch the pinion with your hand to prevent it from falling and being damaged.

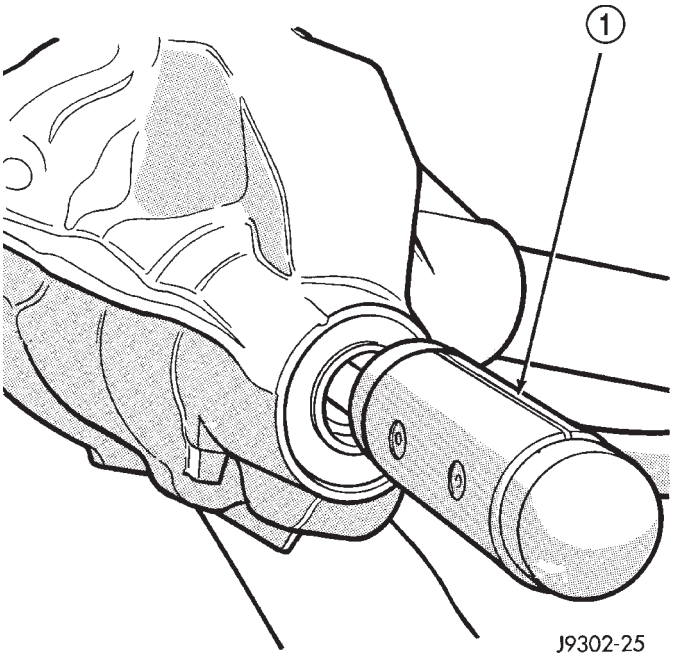

Fig. 18 Remove Pinion

1 – RAWHIDE HAMMER

(12) Using a suitable pry tool, or a slide hammer mounted screw, remove the pinion seal.

(13) Remove oil slinger, if equipped, and front pinion bearing.

(14) Remove the front pinion bearing cup with Remover D–103 and Handle C–4171 (Fig. 19).

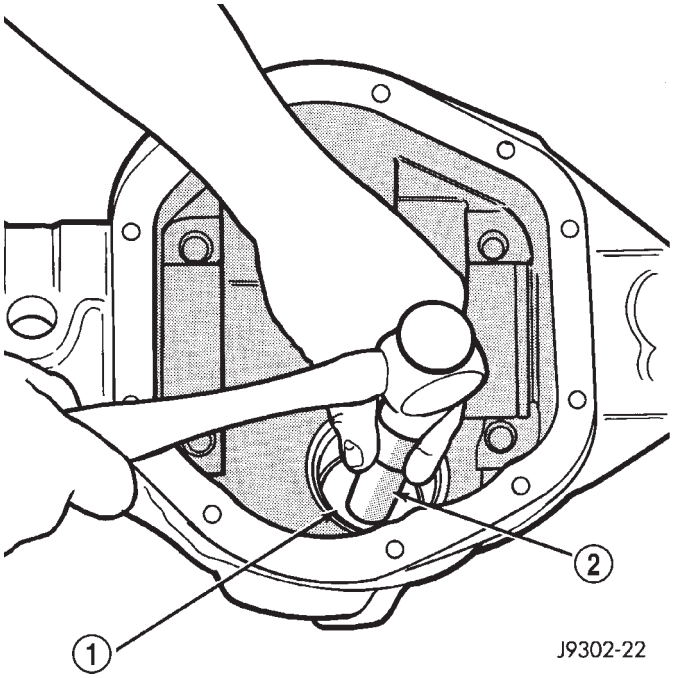

Fig. 19 Front Bearing Cup Removal

1 – REMOVER
2 – HANDLE

(15) Remove the rear bearing cup from housing (Fig. 20). Use Remover 8401 and Handle C–4171.

(16) Remove the collapsible preload spacer (Fig. 21).

(17) Remove the rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-42 (Fig. 22).

Place 4 adapter blocks so they do not damage the bearing cage.

(18) Remove the depth shims from the pinion shaft. Record the thickness of the depth shims.

REMOVAL AND INSTALLATION (Continued)

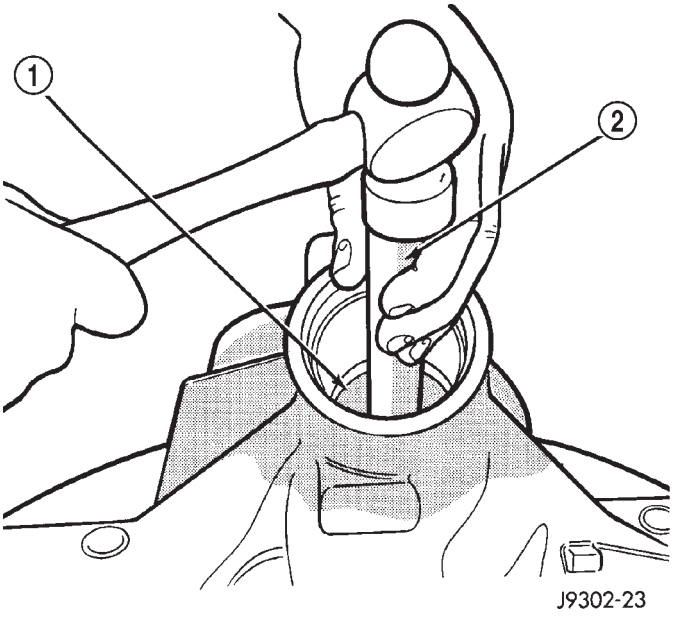

Fig. 20 Rear Bearing Cup Removal

1 – DRIVER
2 – HANDLE

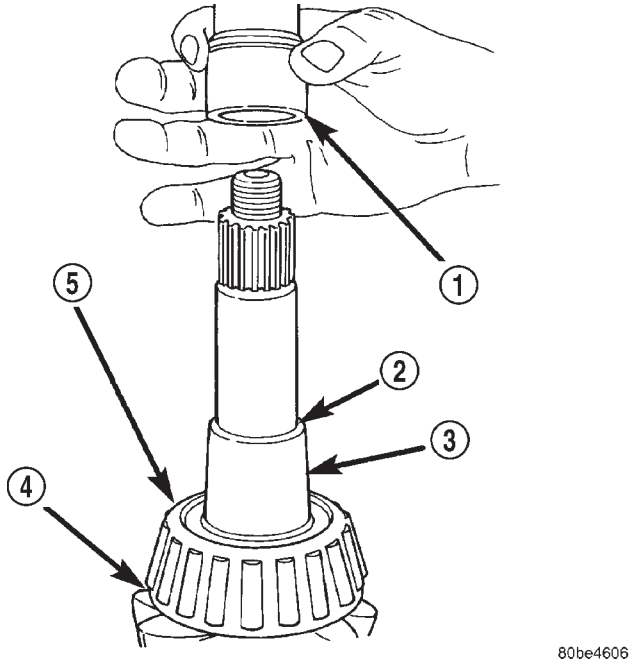

Fig. 21 Collapsible Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION
4 – PINION DEPTH SHIM
5 – REAR BEARING

INSTALLATION

(1) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

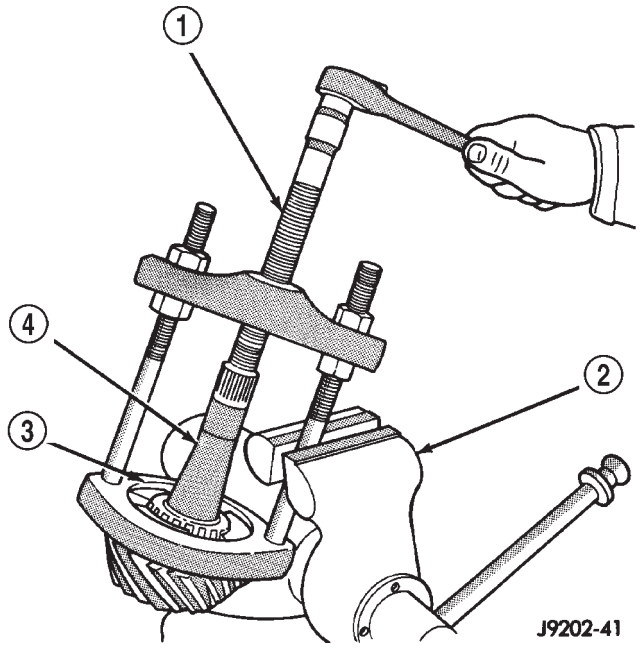

Fig. 22 Rear Bearing Removal

1 – SPECIAL TOOL C-293–PA
2 – VISE
3 – ADADPTERS
4 – DRIVE PINION GEAR SHAFT

(2) Install the pinion rear bearing cup with Installer D-145 and Driver Handle C–4171 (Fig. 23). Ensure cup is correctly seated.

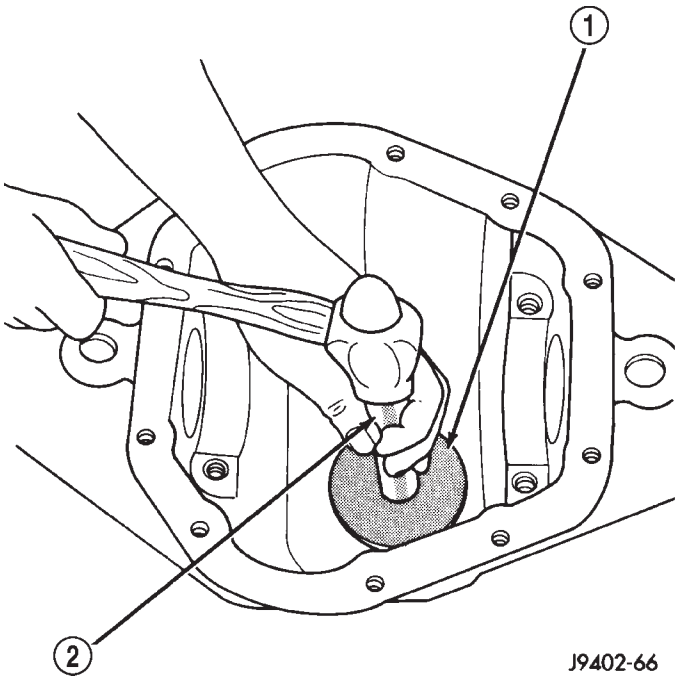

Fig. 23 Pinion Rear Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

REMOVAL AND INSTALLATION (Continued)

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(4) Install the pinion front bearing cup with Installer D–129 and Handle C–4171 (Fig. 24).

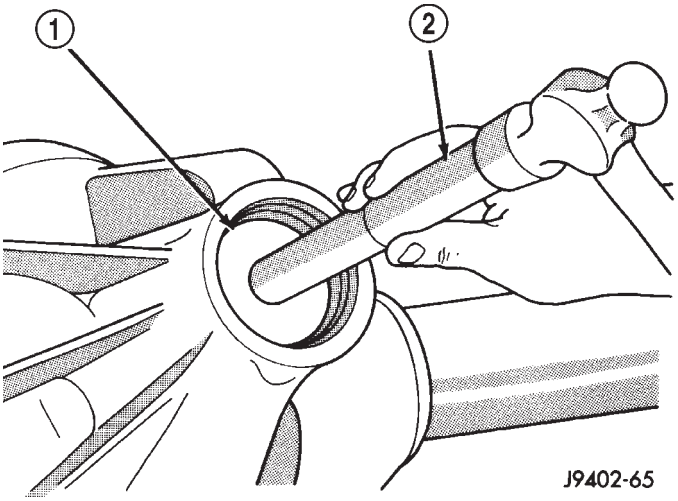

Fig. 24 Pinion Front Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

(5) Install pinion front bearing, and oil slinger, if equipped.

(6) Apply a light coating of gear lubricant on the lip of pinion seal.

(7) Install seal with Installer C-3972-A and Handle C–4171 (Fig. 25).

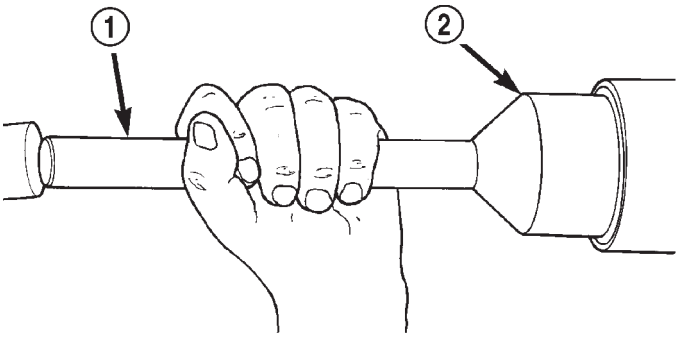

Fig. 25 Pinion Seal Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3972–A

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion gear head to achieve proper ring gear and pinion mesh. If the factory installed ring gear and pinion are reused, the pinion depth shim should not require replacement. If required, refer to Pinion Gear Depth to select the proper thickness shim before installing rear pinion bearing.

(8) Place the proper thickness depth shim on the pinion shaft.

(9) Install the rear bearing and slinger, if equipped, onto the pinion shaft with Installer 6448 (Fig. 26).

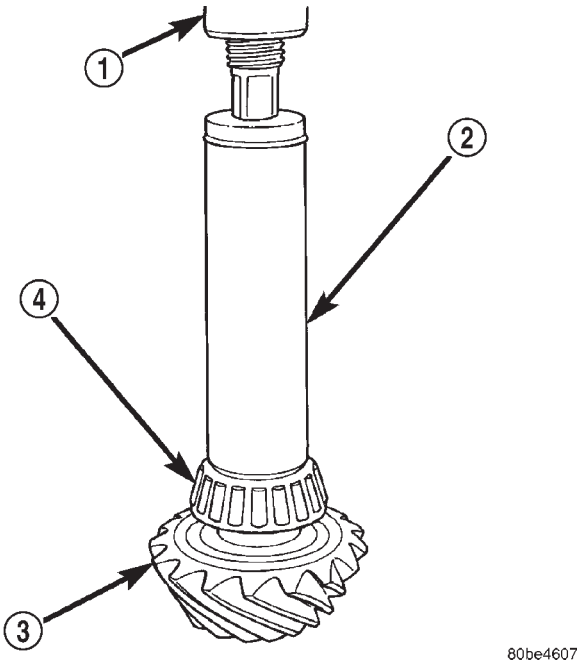

Fig. 26 Shaft Rear Bearing Installation

1 – PRESS
2 – INSTALLATION TOOL
3 – DRIVE PINION
4 – DRIVE PINION SHAFT REAR BEARING

(10) Install a new collapsible preload spacer onto the pinion shaft (Fig. 27).

(11) Install the pinion in the axle housing.

(12) Install the companion flange with Installer C-3718 and Holder 6719.

CAUTION: Do not exceed the minimum tightening torque when installing the companion flange at this point. Damage to the collapsible spacer or bearings may result.

(13) Install the new pinion nut onto the pinion shaft and tighten the pinion nut until there is zero bearing end-play (Fig. 28).

(14) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(15) Using Holder 6719 and a torque wrench set at 474 N·m (350 ft. lbs.), crush collapsible spacer until bearing end play is taken up.

REMOVAL AND INSTALLATION (Continued)

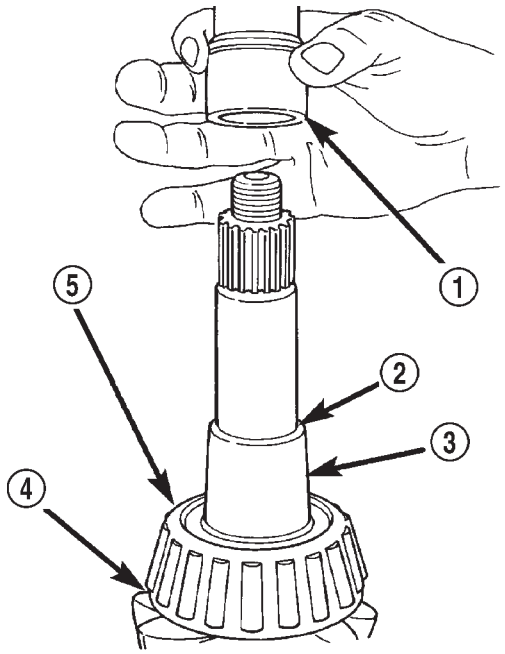

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Fig. 27 Collapsible Preload Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION
4 – PINION DEPTH SHIM
5 – REAR BEARING

NOTE: If the spacer requires more than 474 N·m (350 ft. lbs.) torque to crush, the collapsible spacer is defective and must be replaced.

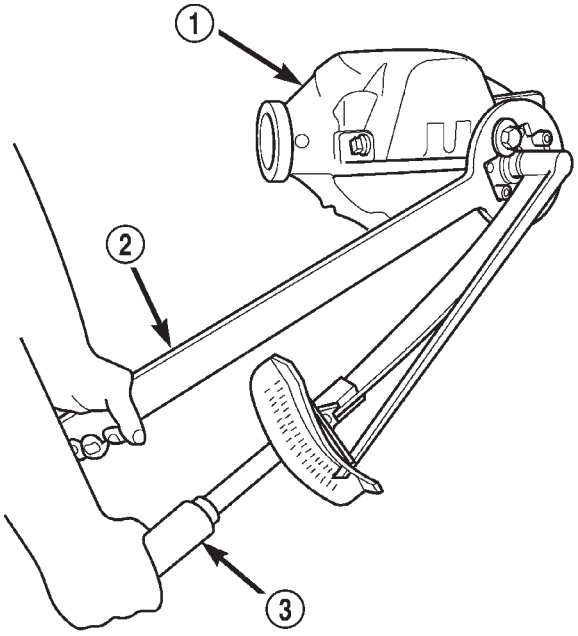

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Fig. 28 Tighten Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

(16) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired rotating torque is achieved. Measure the rotating torque frequently to avoid overcrushing the collapsible spacer (Fig. 29).

(17) Check bearing rotating torque with an inch pound torque wrench (Fig. 29). The torque necessary to rotate the pinion should be:

- Original Bearings — 1 to 2.5 N·m (10 to 20 in. lbs.).
- New Bearings — 1.0 to 2.5 N·m (15 to 22 in. lbs.).

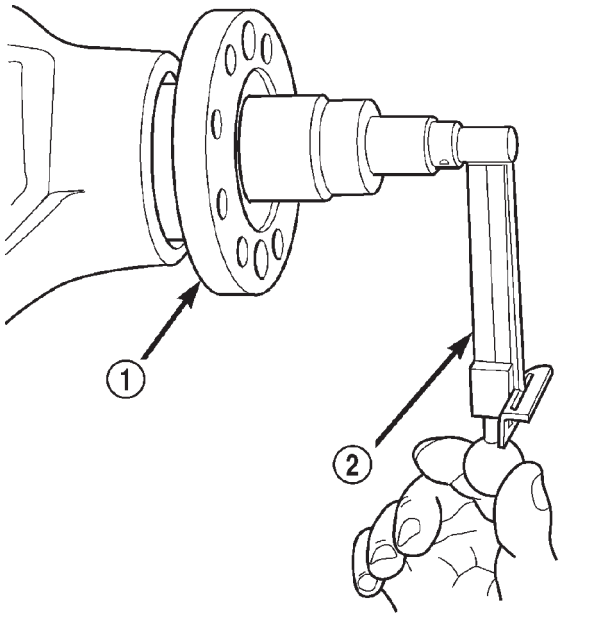

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Fig. 29 Check Pinion Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

(18) Install the differential in the axle housing.

FINAL ASSEMBLY

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, on the housing cover (Fig. 30).

Install the housing cover within 5 minutes after applying the sealant.

(2) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 23 N·m (17 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

REMOVAL AND INSTALLATION (Continued)

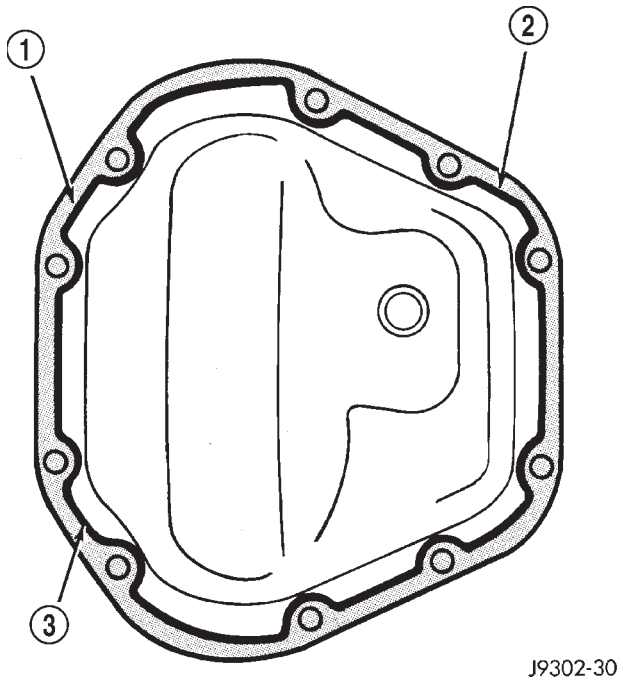


Fig. 30 Typical Housing Cover With Sealant

1 – SEALING SURFACE
2 – CONTOUR OF BEAD
3 – BEAD THICKNESS 6.35MM (1/4")

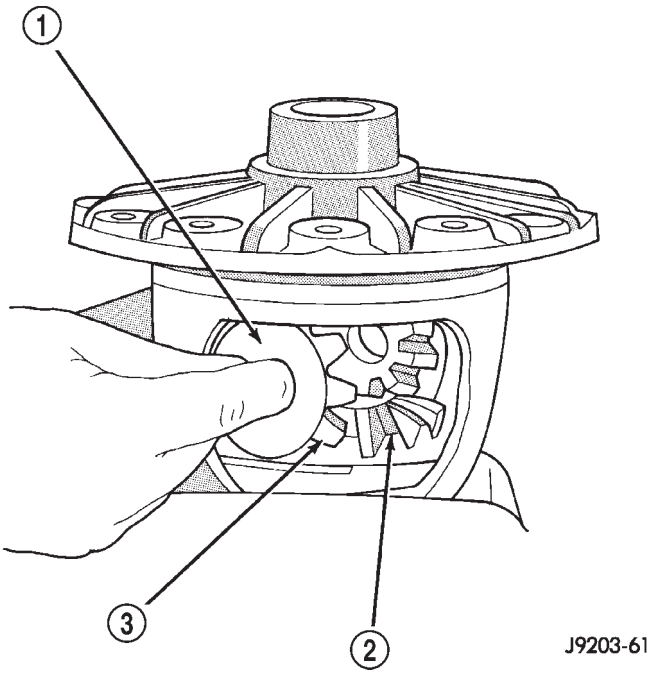


Fig. 31 Pinion Mate Gear Removal

1 – THRUST WASHER
2 – SIDE GEAR
3 – PINION MATE GEAR

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove ring gear.
(2) Remove roll-pin holding mate shaft in housing.
(3) Remove pinion gear mate shaft.
(4) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 31).
(5) Remove the differential side gears and thrust washers.

ASSEMBLY

(1) Install the differential side gears and thrust washers.
(2) Install the pinion mate gears and thrust washers.
(3) Install the pinion gear mate shaft.
(4) Align the hole in the pinion gear mate shaft with the hole in the differential case.
(5) Install and seat the pinion mate shaft roll-pin in the differential case and mate shaft with a punch and hammer (Fig. 32). Peen the edge of the roll-pin hole in the differential case slightly in two places, 180° apart.
(6) Lubricate all differential components with hypoid gear lubricant.
(7) Install ring gear.

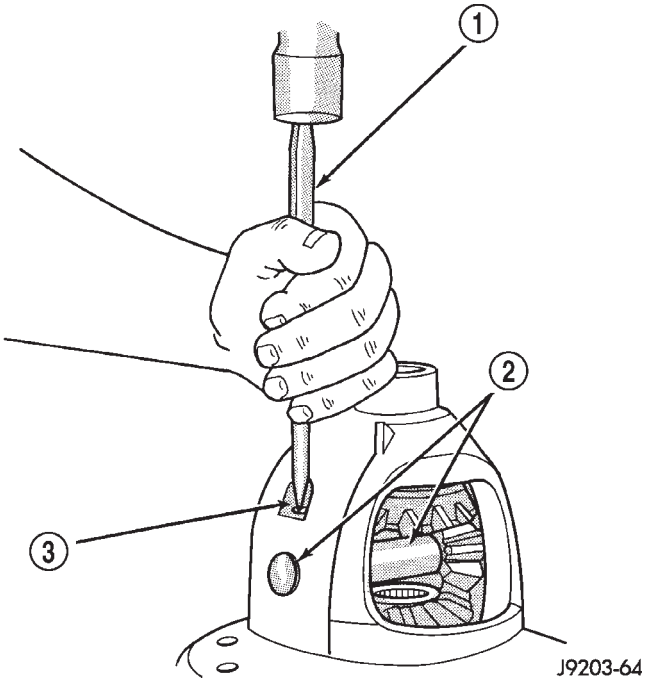


Fig. 32 Pinion Mate Shaft Roll-Pin Installation

1 – PUNCH
2 – PINION MATE SHAFT
3 – MATE SHAFT LOCKPIN

CLEANING AND INSPECTION

AXLE COMPONENTS

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle shaft tubes and oil channels in housing.

Inspect for;

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
- Ring gear and pinion for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Companion flange for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Preload shims for damage and distortion. Install new shims, if necessary.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL INFORMATION

Ring gear and pinion are supplied as matched sets only. The identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (-) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard setting from the center line of the ring gear to the back face of the pinion is 99.690 mm (3.925 in.). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed between the rear pinion bearing cone and the pinion gear head. (Fig. 33).

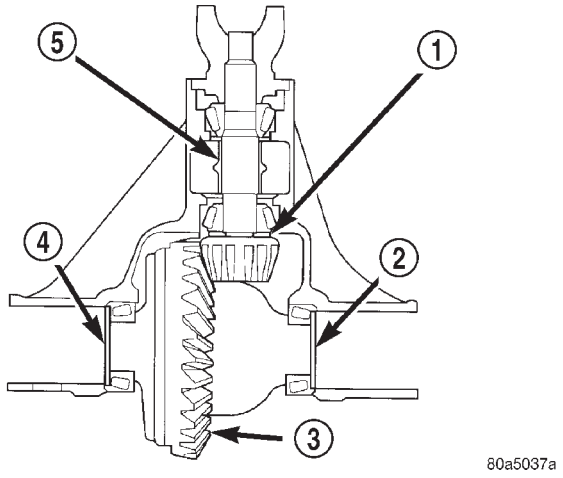


Fig. 33 Shim Locations

1 – PINION GEAR DEPTH SHIM
2 – DIFFERENTIAL BEARING SHIM-PINION GEAR SIDE
3 – RING GEAR
4 – DIFFERENTIAL BEARING SHIM-RING GEAR SIDE
5 – COLLAPSIBLE SPACER

If a new gear set is being installed, note the depth variance marked on both the original and replacement pinion. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus amount needed.

Note the painted number on the shaft of the drive pinion (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.

ADJUSTMENTS (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with a Pinion Gauge Set, Pinion Block 8177, Arbor Discs 8541, and Dial Indicator C-3339 (Fig. 38).

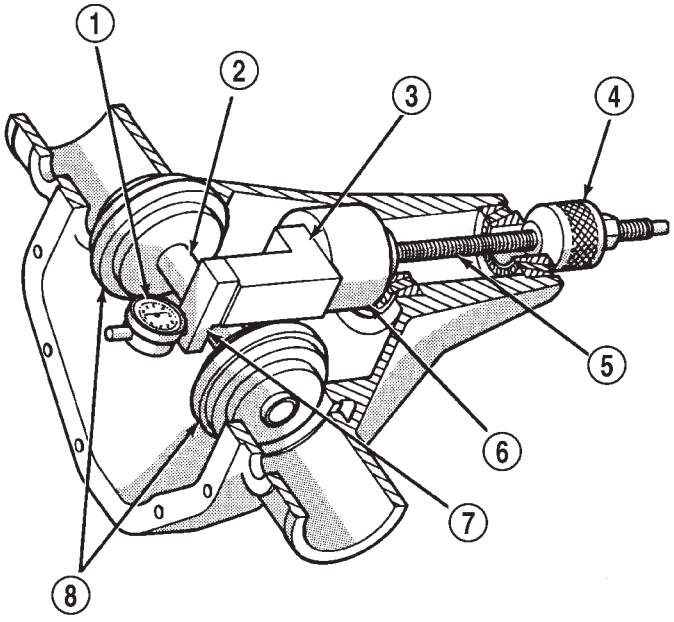


Fig. 34 Pinion Gear Depth Gauge Tools

1 – DIAL INDICATOR
2 – ARBOR
3 – PINION HEIGHT BLOCK
4 – CONE
5 – SCREW
6 – PINION BLOCK
7 – SCOOTER BLOCK
8 – ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 8177, and rear pinion bearing onto Screw 6741 (Fig. 34).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through the pinion bearing cups (Fig. 35).

(3) Install front pinion bearing and Cone 6740 onto the screw hand tight (Fig. 34).

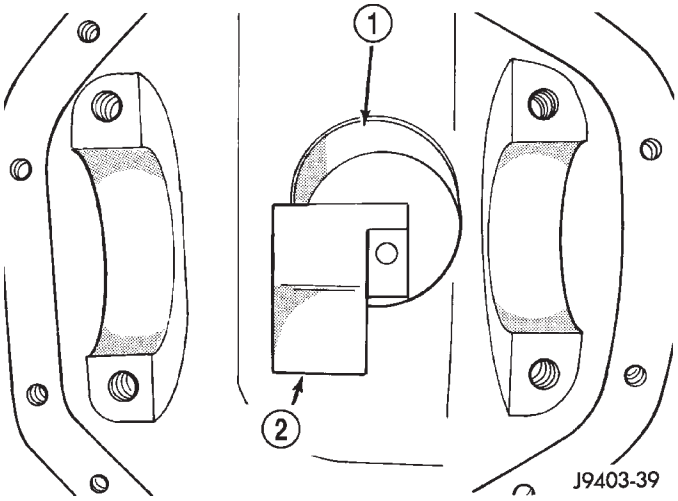


Fig. 35 Pinion Height Block

1 – PINION BLOCK
2 – PINION HEIGHT BLOCK

(4) Place Arbor Discs 8541 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 36). Install differential bearing caps on Arbor Discs and tighten cap bolts. Refer to the Torque Specifications in this section.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the surface of the pinion height block.

ADJUSTMENTS (Continued)

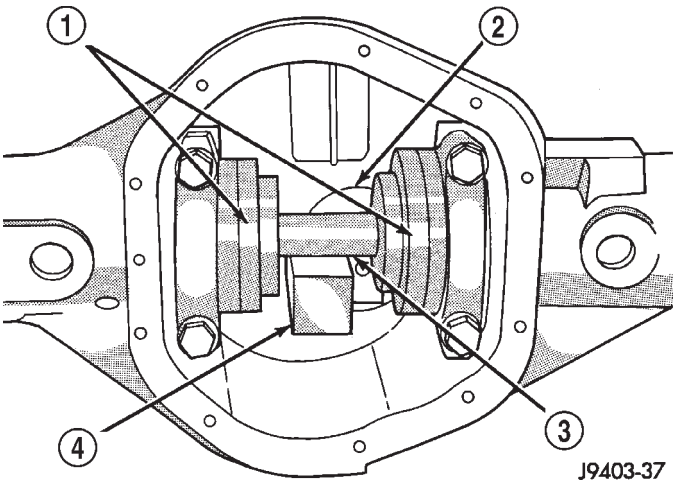


Fig. 36 Gauge Tools In Housing

1 – ARBOR DISC
2 – PINION BLOCK
3 – ARBOR
4 – PINION HEIGHT BLOCK

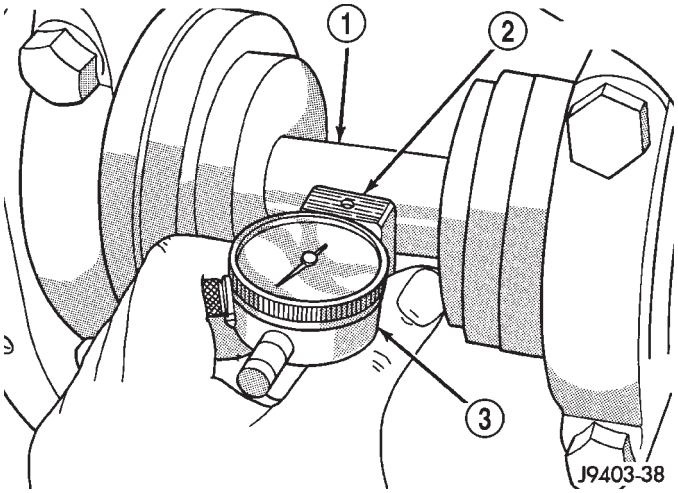


Fig. 37 Pinion Gear Depth Measurement

1 – ARBOR
2 – SCOOTER BLOCK
3 – DIAL INDICATOR

Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block. Observe how many revolutions counterclockwise the dial pointer travels (approximately 0.125 in.) to the out-stop of the dial indicator.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 37). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number marked on the shaft of the pinion gear using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

(10) Remove the pinion depth gauge components from the axle housing

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the axle housing. The proper shim thickness can be determined using slip-fit Dummy Bearings 8398 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading, starting point shim thicknesses, and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion side of the differential (Fig. 38).

SHIM SELECTION

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

(1) Remove side bearings from differential case.

(2) Install ring gear, if necessary, on differential case and tighten bolts to specification.

(3) Install Dummy Side Bearings 8398 on differential case.

(4) Install differential case in axle housing.

ADJUSTMENTS (Continued)

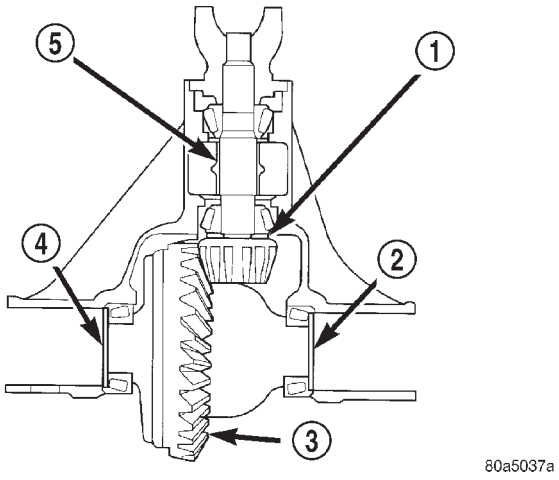


Fig. 38 Axle Adjustment Shim Locations

1 – PINION GEAR DEPTH SHIM
2 – DIFFERENTIAL BEARING SHIM-PINION GEAR SIDE
3 – RING GEAR
4 – DIFFERENTIAL BEARING SHIM-RING GEAR SIDE
5 – COLLAPSIBLE SPACER

(5) Insert Dummy Shims 8107 (0.118 in. (3.0 mm)) starting point shims between both dummy bearings and the axle housing (Fig. 39).

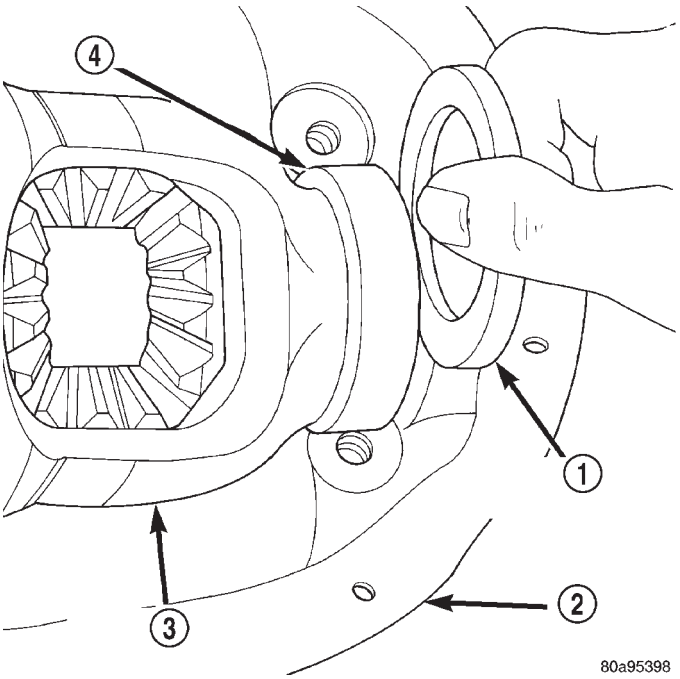


Fig. 39 Insert Starting Point Shims

1 – SPECIAL TOOL 8107
2 – AXLE HOUSING
3 – DIFFERENTIAL CASE
4 – SPECIAL TOOL D-348

(6) Install the marked bearing caps in their correct positions. Install and snug the bolts.

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 40) and (Fig. 41).

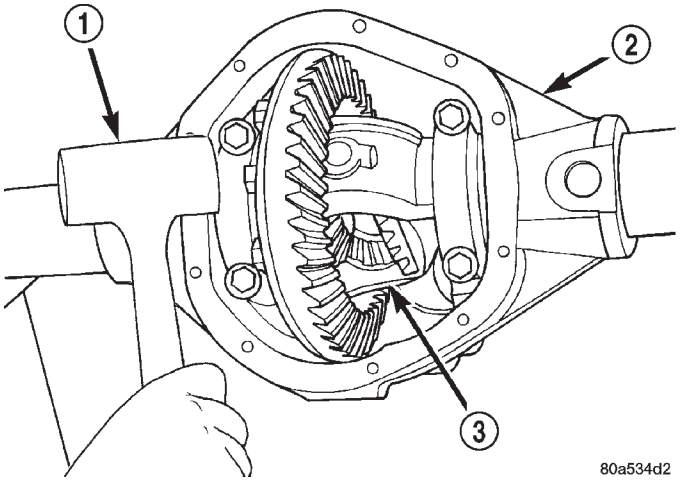


Fig. 40 Seat Pinion Side Dummy Side Bearing

1 – MALLET
2 – AXLE HOUSING
3 – DIFFERENTIAL CASE

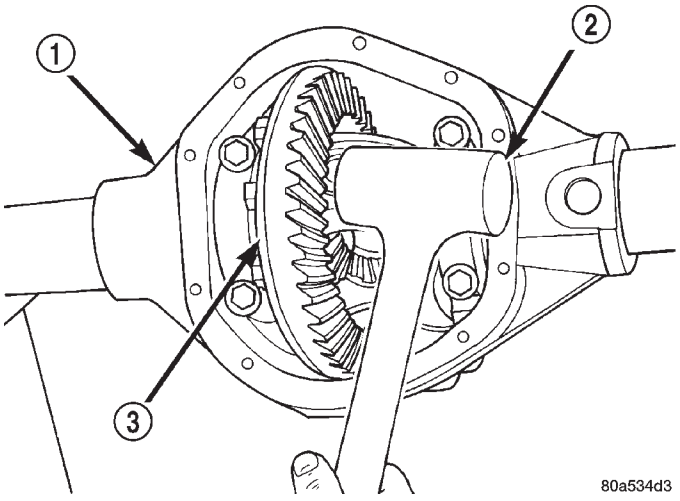


Fig. 41 Seat Ring Gear Side Dummy Bearing

1 – AXLE HOUSING
2 – MALLET
3 – DIFFERENTIAL CASE

(8) Thread guide stud L-4438 into rear cover bolt hole below ring gear (Fig. 42).

(9) Attach dial indicator C-3339 to guide stud. Position the dial indicator plunger on a flat surface on a ring gear bolt head (Fig. 42).

(10) Push firmly and hold differential case to pinion side of axle housing (Fig. 43).

(11) Zero dial indicator face to pointer.

(12) Push firmly and hold differential case to ring gear side of the axle housing (Fig. 44).

ADJUSTMENTS (Continued)

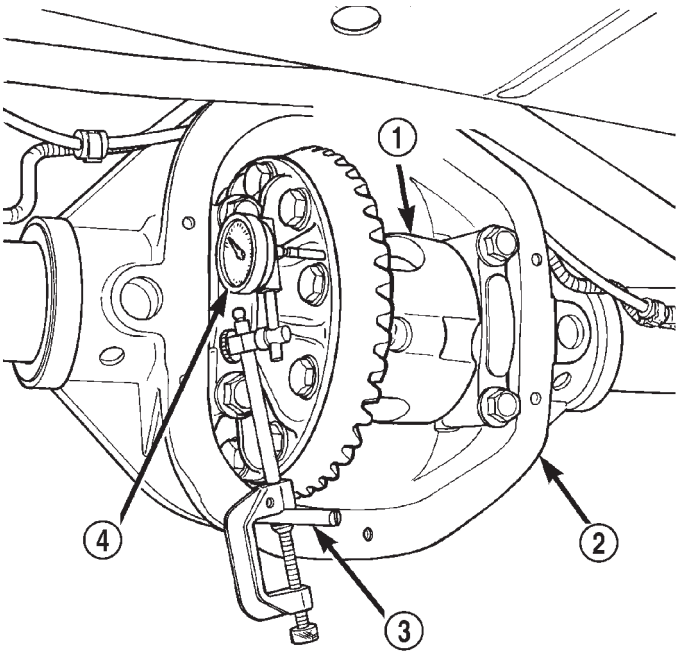


Fig. 42 Differential Side play Measurement

1 – DIFFERENTIAL CASE
2 – AXLE HOUSING
3 – SPECIAL TOOL L-4438
4 – SPECIAL TOOL C-3339

(13) Record dial indicator reading.

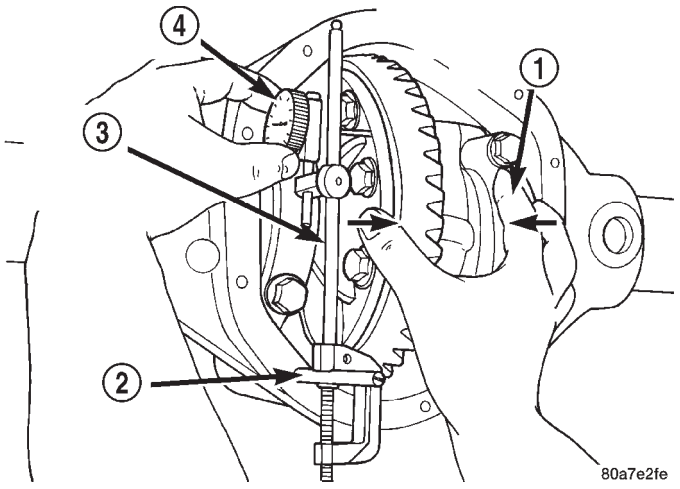


Fig. 43 Hold Differential Case and Zero Dial Indicator

1 – FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
2 – SPECIAL TOOL L-4438
3 – SPECIAL TOOL C-3339
4 – ZERO DIAL INDICATOR FACE

(14) Add the dial indicator reading to the starting point shim thicknesses to determine the total shim thickness necessary to achieve zero differential end play.

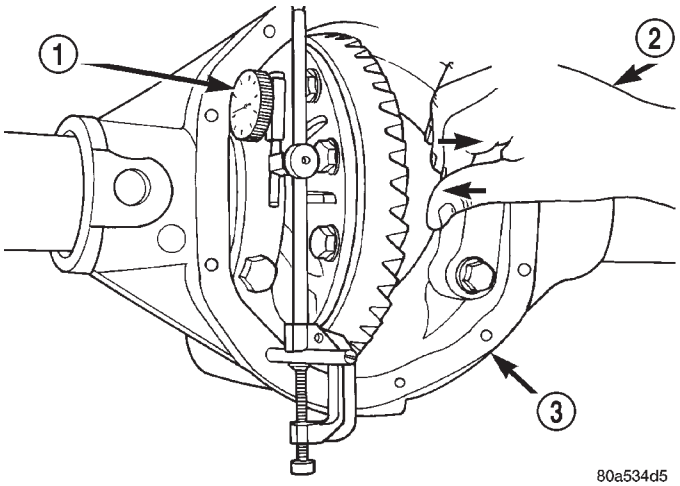


Fig. 44 Hold Differential Case and Read Dial Indicator

1 – READ DIAL INDICATOR
2 – FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 – AXLE HOUSING

(15) Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims necessary to compress, or preload the new bearings when the differential is installed.

(16) Rotate dial indicator out of the way on guide stud.

(17) Remove differential case, dummy bearings, and starting point shims from the axle housing.

(18) Install the pinion in the axle housing. Install the companion flange and establish the correct pinion rotating torque.

(19) Install differential case and dummy bearings in axle housing with a single Dummy Shim 8107 on the ring gear side of the axle and tighten retaining cap bolts.

(20) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 46).

(21) Push and hold differential case toward pinion.

(22) Zero dial indicator face to pointer.

(23) Push and hold differential case to ring gear side of the axle housing.

(24) Record dial indicator reading.

(25) Subtract 0.002 in. (0.05 mm) from the dial indicator reading to compensate for backlash between ring and pinion gears. Add the resulting measurement to the thickness of the single starting point shim. This total is the thickness of shim required to achieve proper backlash.

(26) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.

(27) Rotate dial indicator out of the way on guide stud.

(28) Remove differential case, dummy bearings, and dummy shim from axle housing.

ADJUSTMENTS (Continued)

(29) Install new side bearing cones and cups on differential case.

(30) Install spreader W-129-B, utilizing Adapter Plates 8142-A, on axle housing and spread axle opening enough to receive differential case.

(31) Place the side bearing shims in the axle housing against the axle housing shoulder.

(32) Install the differential case in the axle housing.

(33) Rotate the differential case several times to seat the side bearings.

(34) Position the indicator plunger against a ring gear tooth (Fig. 45).

(35) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(36) Zero dial indicator face to pointer.

(37) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the differential housing to the other (Fig. 46).

(38) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform the Gear Contact Pattern Analysis procedure.

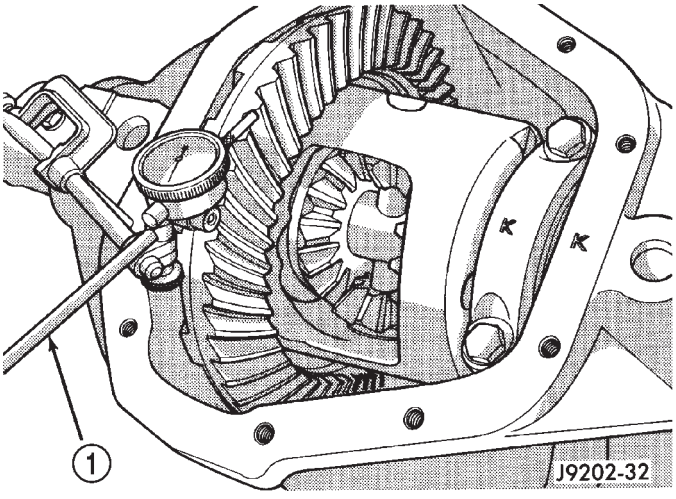


Fig. 45 Ring Gear Backlash Measurement

1 – DIAL INDICATOR

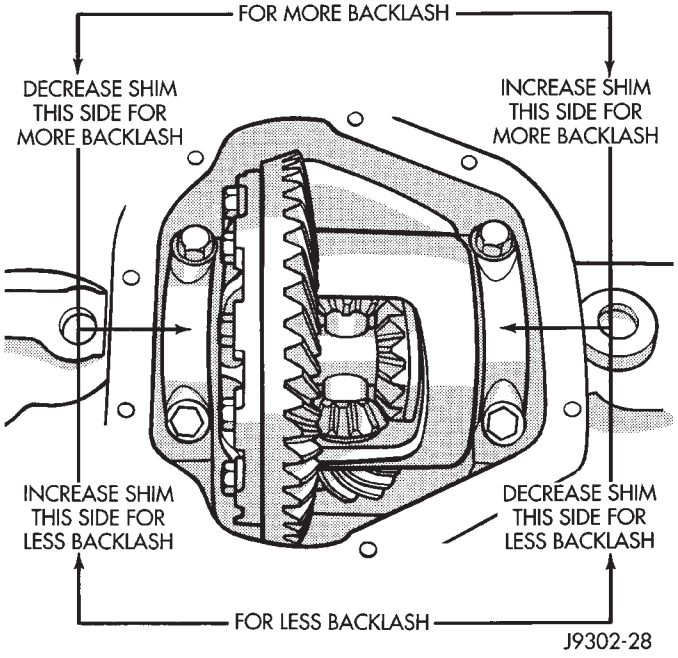


Fig. 46 Backlash Shim Adjustment

GEAR CONTACT PATTERN ANALYSIS

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

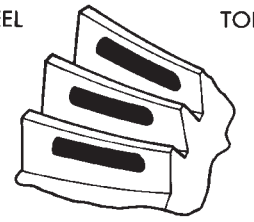
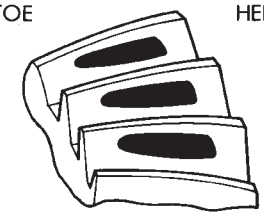
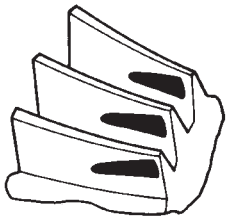
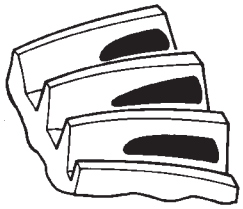
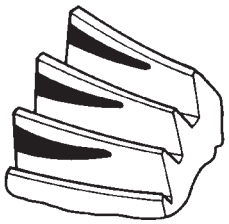
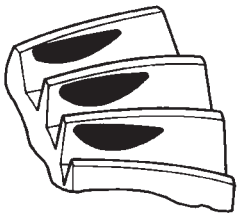
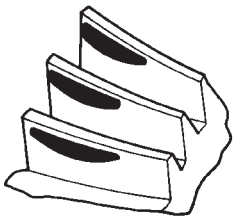
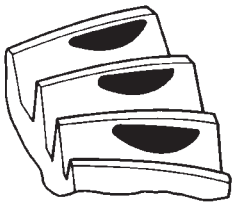
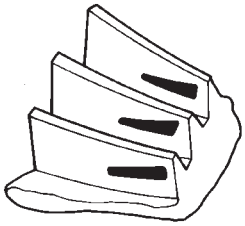
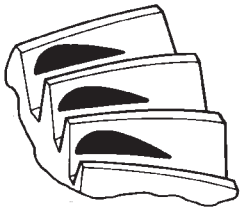
(1) Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 47) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)

DRIVE SIDE OF RING GEAR TEETH	COAST SIDE OF RING GEAR TEETH	
HEEL TOE 	TOE HEEL 	DESIRABLE CONTACT PATTERN. PATTERN SHOULD BE CENTERED ON THE DRIVE SIDE OF TOOTH. PATTERN SHOULD BE CENTERED ON THE COAST SIDE OF TOOTH, BUT MAY BE SLIGHTLY TOWARD THE TOE. THERE SHOULD ALWAYS BE SOME CLEARANCE BETWEEN CONTACT PATTERN AND TOP OF THE TOOTH.
		RING GEAR BACKLASH CORRECT. **THINNER** PINION GEAR DEPTH SHIM REQUIRED.
		RING GEAR BACKLASH CORRECT. **THICKER** PINION GEAR DEPTH SHIM REQUIRED.
		PINION GEAR DEPTH SHIM CORRECT. **DECREASE** RING GEAR BACKLASH.
		PINION GEAR DEPTH SHIM CORRECT. **INCREASE** RING GEAR BACKLASH.

J9003-24

Fig. 47 Gear Tooth Contact Patterns

SPECIFICATIONS

C205F AXLE

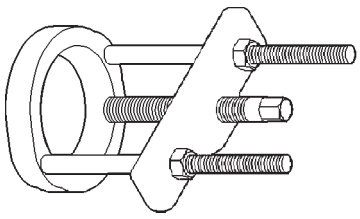
DESCRIPTION	SPECIFICATION
Axle Type	Semi–Floating Hypoid
Lubricant	SAE Thermally Stable 80W–90
Lube Capacity	1.66 L (3.5 pts.)
Axle Ratios	3.55, 3.92
Differential Bearing Preload	0.203 mm (0.008 in.)
Differential Side Gear Clearance	0–0.15 mm (0–0.006 in.)
Ring Gear Diameter	205 mm (7.562 in.)
Ring Gear Backlash	0.12–0.20 mm (0.005–0.008 in.)
Pinion Std. Depth	99.69 mm (3.925 in.)
Pinion Bearing Preload-Original Bearings	1–3 N·m (10–20 in. lbs.)
Pinion Bearing Preload-New Bearings	1.7–2.5 N·m (15–22 in. lbs.)

C205F AXLE

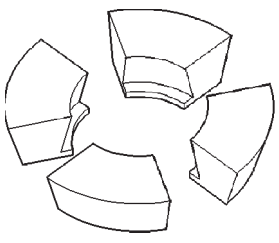
DESCRIPTION	TORQUE
Bolt, Diff. Cover	23 N·m (15 ft. lbs.)
Bolt, Bearing Cap	61 N·m (45 ft. lbs.)
Nut, Pinion	271–474 N·m (200–350 ft. lbs.)
Bolt, Ring Gear	95–122 N·m (70–90 ft. lbs.)

SPECIAL TOOLS

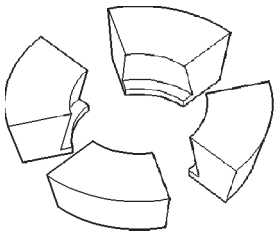
C205F AXLE



Puller—C-293-PA



Adapter—C-293-42



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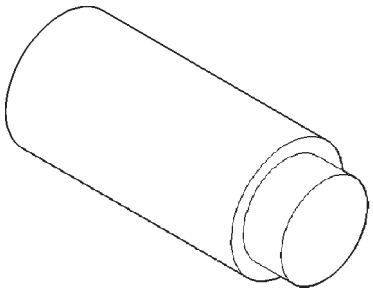
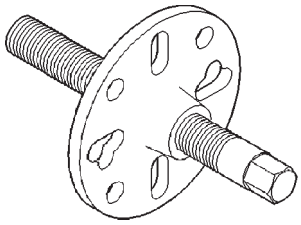
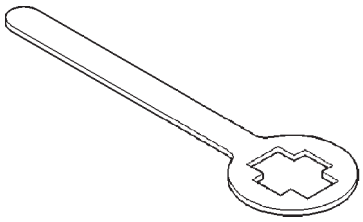


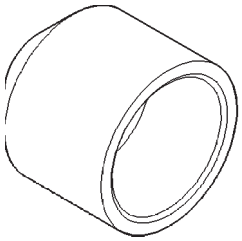
Plug—C-293-3



Puller—C-452

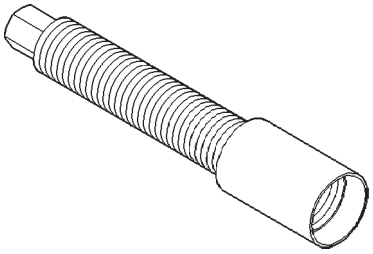


Holder—6719A

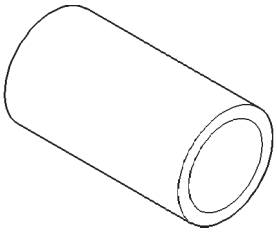


Installer—C-3972-A

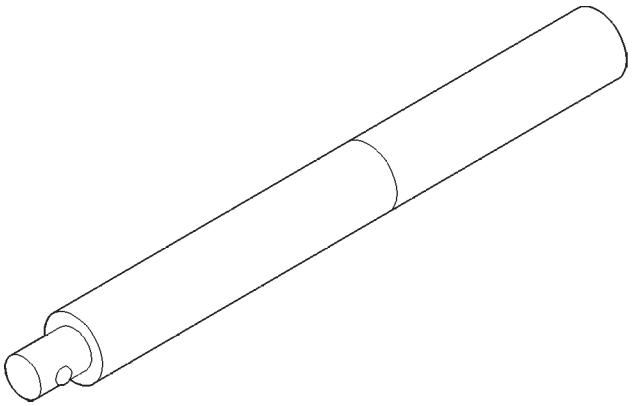
SPECIAL TOOLS (Continued)



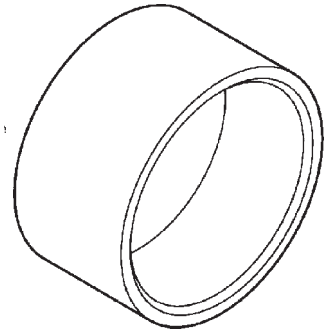
Installer Screw—8112



Cup—8109



Handle—C-4171



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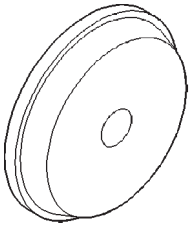

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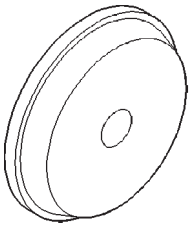

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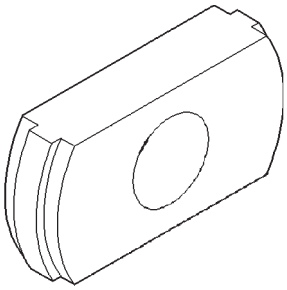
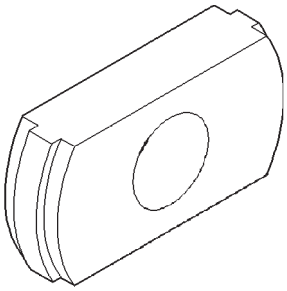
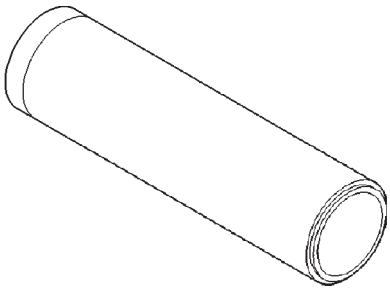


Remover—D-103



Remover—8401



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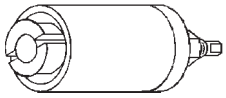
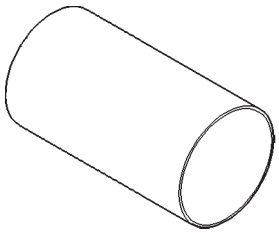


Bearing Remover—C-4660



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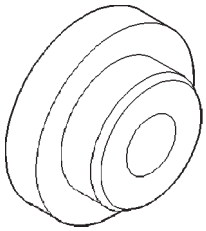

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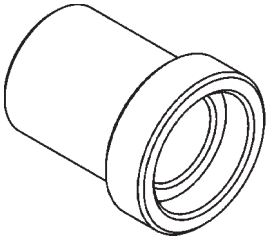

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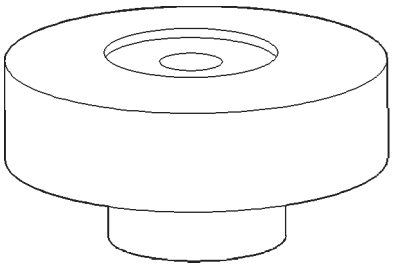
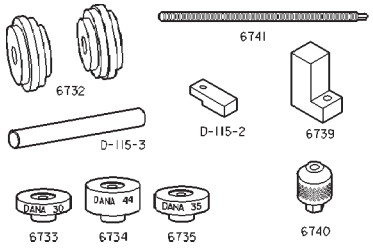
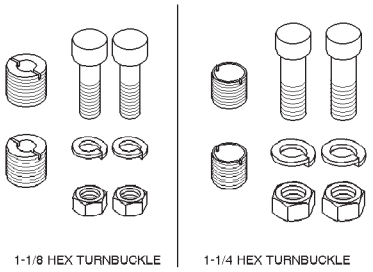


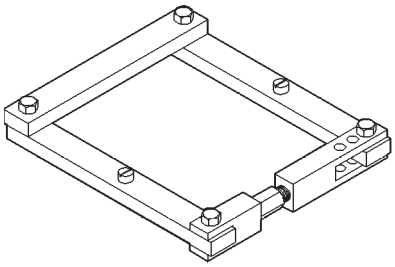
Gauge Block—8177



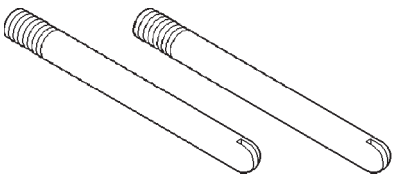
Tool Set, Pinion Depth



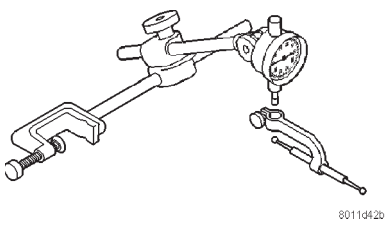
Adapter Kit—6987A



Spreader—W-129-B

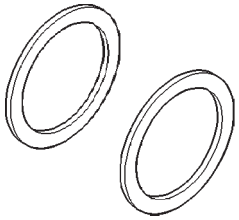


Guide Pin—C-3288-B



Dial Indicator—C-3339

SPECIAL TOOLS (Continued)



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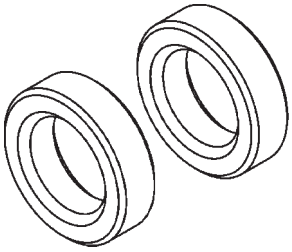


Dummy Bearing—8398

8 1/4 AND 9 1/4 AXLE

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

8 1/4 AXLE

DESCRIPTION

The 8 1/4 inch axle housings consist of a cast iron center section with axle tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing (Fig. 1).

The axles have a vent hose to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning vehicle loads are supported by the axle shaft and bearings. The axle shafts are retained by C-locks in the differential side gears.

The removable, stamped steel cover provides a means for inspection and service without removing the complete axle from the vehicle.

The 8 1/4 axle have a date tag and a gear ratio tag. The tags are attached to the differential housing by a cover bolt.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a threaded pin. Differential bearing preload and ring gear backlash are set and maintained by threaded adjusters at the outside of the differential housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

Axles equipped with a Trac-Lok™ differential are optional. A Trac-Lok™ differential has a one-piece differential case, and the same internal components as a standard differential, plus two clutch disc packs.

AXLE IDENTIFICATION

The axle differential cover can be used for identification of the axle (Fig. 2). A tag is also attached to the cover.

DESCRIPTION AND OPERATION (Continued)

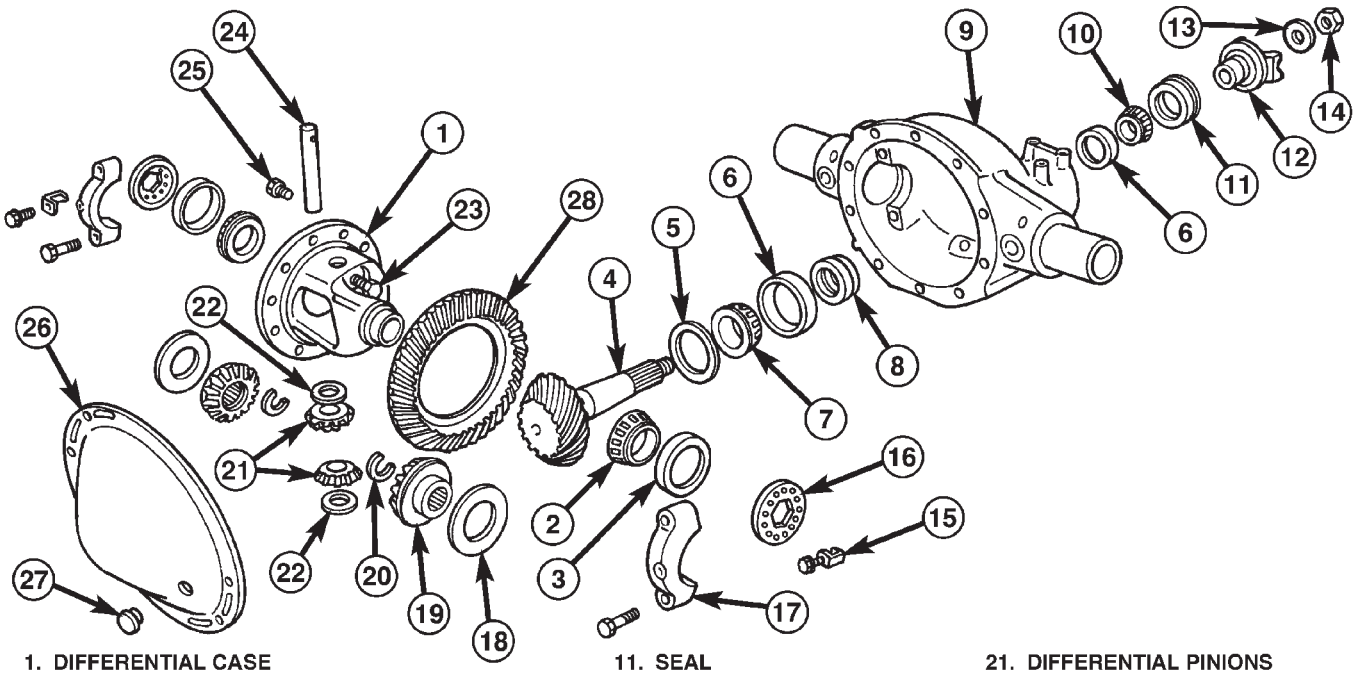


Fig. 1 8 1/4 Axle

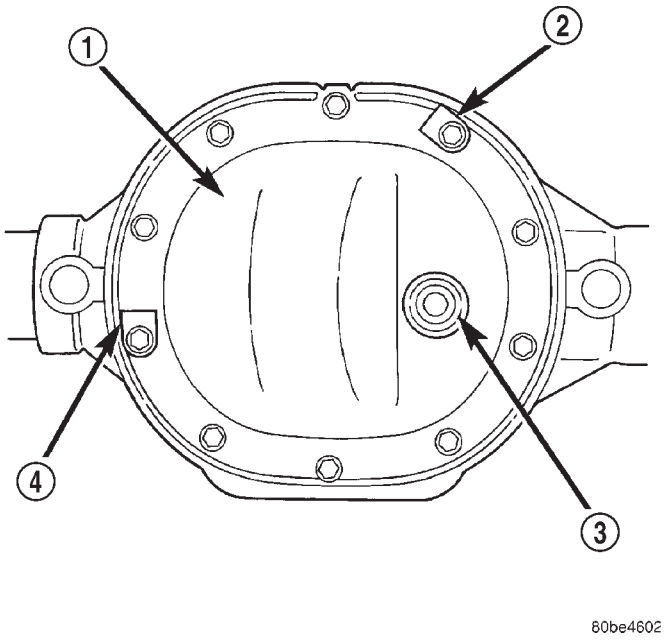


Fig. 2 Differential Cover 8 1/4 Inch Axle

1 – DIFFERENTIAL COVER
2 – IDENTIFICATION TAG
3 – PUSH—IN FILL PLUG
4 – DATE TAG

OPERATION

The axle receives power from the transmission transfer case through the rear propeller shaft. The rear propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

DESCRIPTION AND OPERATION (Continued)

9 1/4 AXLES

DESCRIPTION

The 9 1/4 Inch axle housings consist of a cast iron center section with axle tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing (Fig. 3).

The axles have a vent hose to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning vehicle loads are supported by the axle shaft and bearings. The axle shafts are retained by C-locks in the differential side gears.

The removable, stamped steel cover provides a means for inspection and service without removing the complete axle from the vehicle.

The axle has a date tag and a gear ratio tag. The tags are attached to the differential housing by a cover bolt.

The rear wheel anti-lock (RWAL) brake speed sensor is attached to the top, forward exterior of the differential housing. A seal is located between the sensor and the wire harness connector. The seal must be in place when the wire connector is connected to the sensor. The RWAL brake exciter ring is press-fitted onto the differential case against the ring gear flange.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a threaded pin. Differential bearing preload and ring gear backlash are set and maintained by threaded adjusters at the outside of the differential housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

Axles equipped with a Trac-Lok™ differential are optional. A Trac-Lok™ differential has a one-piece differential case, and the same internal components as a standard differential, plus two clutch disc packs.

DESCRIPTION AND OPERATION (Continued)

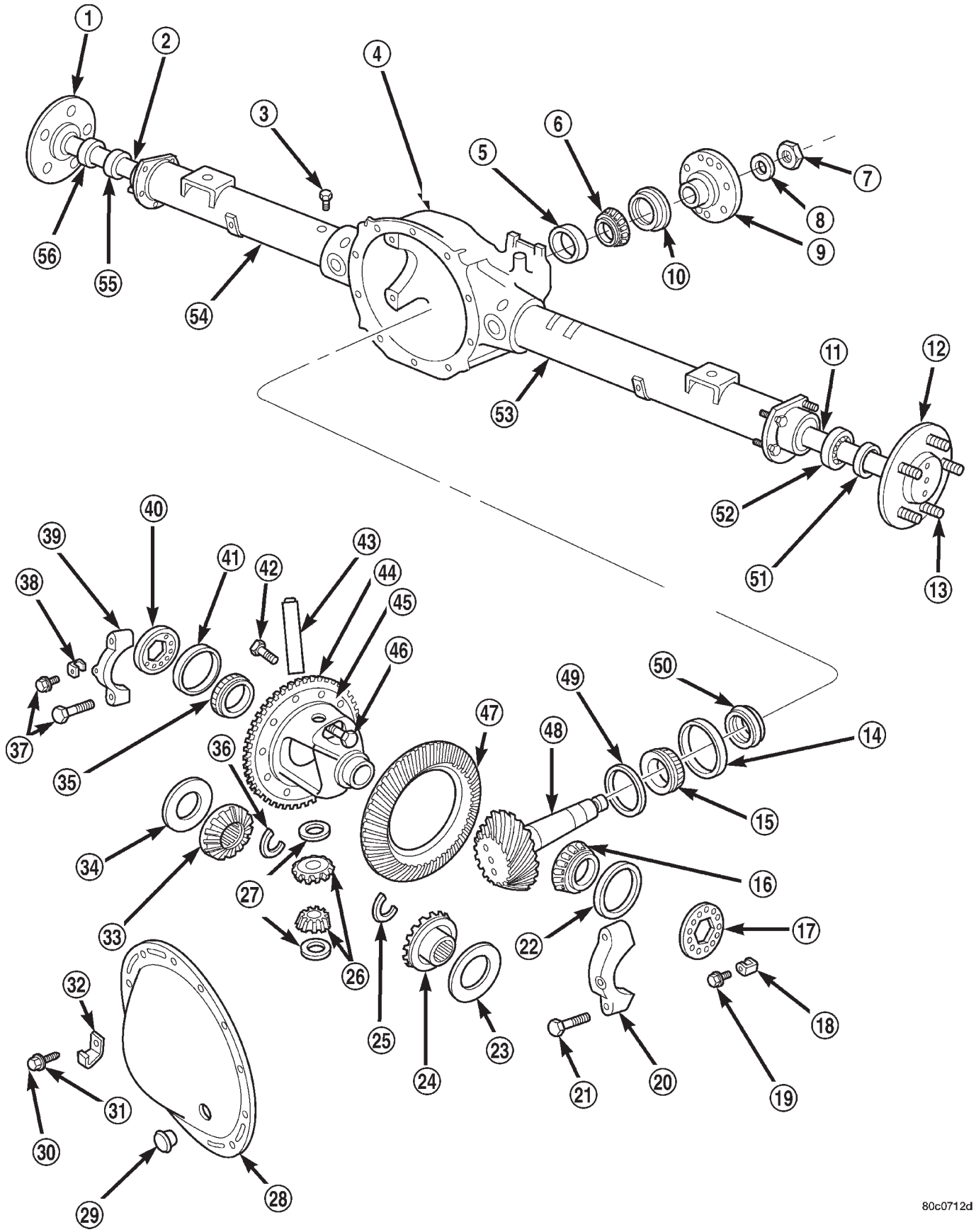


Fig. 3 9 1/4 Axle

DESCRIPTION AND OPERATION (Continued)

1 – HUB
2 – AXLE SHAFT
3 – VENT FITTING
4 – DIFFERENTIAL HOUSING
5 – CUP
6 – PINION FRONT BEARING CONE
7 – NUT
8 – WASHER
9 – COMPANION FLANGE
10 – SEAL
11 – AXLE SHAFT
12 – HUB
13 – STUD
14 – BEARING CUP
15 – PINION REAR BEARING CONE
16 – DIFFERENTIAL BEARING
17 – ADJUSTER
18 – LOCK
19 – BOLT
20 – BEARING CAP
21 – CAP BOLT
22 – BEARING CUP
23 – THRUST WASHER
24 – SIDE GEAR
25 – C—LOCK
26 – DIFFERENTIAL POSITIONS
27 – THRUST WASHER
28 – COVER
29 – PLUG
30 – COVER BOLT
31 – WASHER
32 – CLIP
33 – SIDE GEAR
34 – THRUST WASHER
35 – DIFFERENTIAL BEARING CONE
36 – C—LOCK
37 – BOLT
38 – LOCK
39 – BEARING CUP
40 – ADJUSTER
41 – BEARING CUP
42 – BOLT
43 – PINION MATE SHAFT
44 – EXCITER RING
45 – DIFFERENTIAL CASE
46 – RING GEAR BOLT
47 – RING GEAR
48 – PINION
49 – PINION GEAR DEPTH SHIM
50 – BEARING PRELOAD COLLAPSIBLE SPACER
51 – SEAL
52 – AXLE SHAFT BEARING
53 – AXLE SHAFT TUBE
54 – AXLE TUBE
55 – AXLE SHAFT BEARING
56 – SEAL

AXLE IDENTIFICATION

The axle differential cover can be used for identification of the axle and (Fig. 4). A ratio tag is attached to the differential cover.

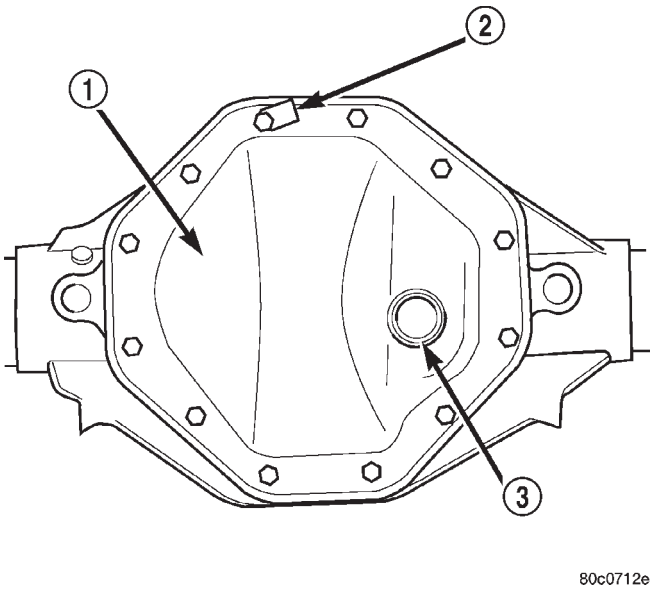


Fig. 4 Differential Cover 9 1/4 Inch Axle

1 – DIFFERENTIAL COVER
2 – RATIO TAG
3 – PUSH—IN FILL PLUG

OPERATION

The axle receives power from the transmission/transfer case through the rear propeller shaft. The rear propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

LUBRICANT

DESCRIPTION

Multi-purpose, hypoid gear lubricant should be used for rear axles with a standard differential. The lubricant should have a MIL-L-2105C and API GL 5 quality specifications.

Trac-Lok differentials require the addition of 5 oz. of friction modifier to the axle lubricant after service. The 8 1/4 axle lubricant capacity is 2.22 L (4.7 pts.) total, including the friction modifier, if necessary. The 9 1/4 axle lubricant capacity is 2.32 L (4.9 pts.) total, including friction modifier, if necessary.

NOTE: If the rear axle is submerged in water, the lubricant must be replaced immediately. Avoid the possibility of premature axle failure resulting from water contamination of the lubricant.

DESCRIPTION AND OPERATION (Continued)

STANDARD DIFFERENTIAL

DESCRIPTION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

OPERATION

In operation, power flow occurs as follows:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (splined to the axle shafts) rotate the shafts

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 5).

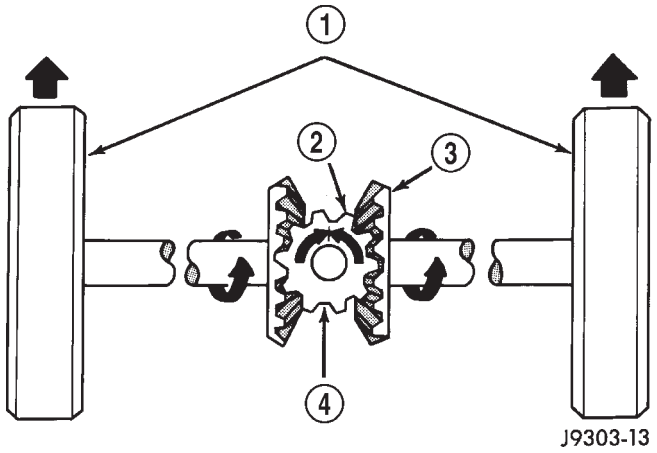


Fig. 5 Differential Operation—Straight Ahead Driving

1 – IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 – PINION GEAR
3 – SIDE GEAR
4 – PINION GEARS ROTATE WITH CASE

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 6). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

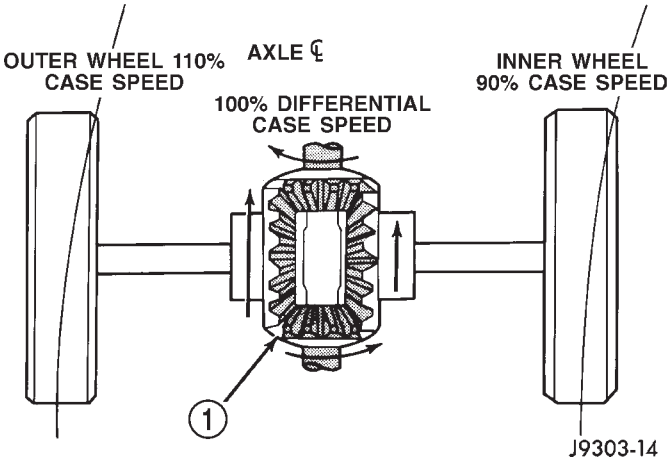


Fig. 6 Differential Operation—On Turns

1 – PINION GEARS ROTATE ON PINION SHAFT

TRAC-LOK™ OPERATION

DESCRIPTION

In a conventional differential, if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

In the Trac-lok™ differential, part of the ring gear torque is transmitted through clutch packs which contain multiple discs. The clutches will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth in appearance.

OPERATION

In operation, the Trac-lok™ clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 7).

The Trac-lok™ design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. Trac-lok™ differentials resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok™ operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

DESCRIPTION AND OPERATION (Continued)

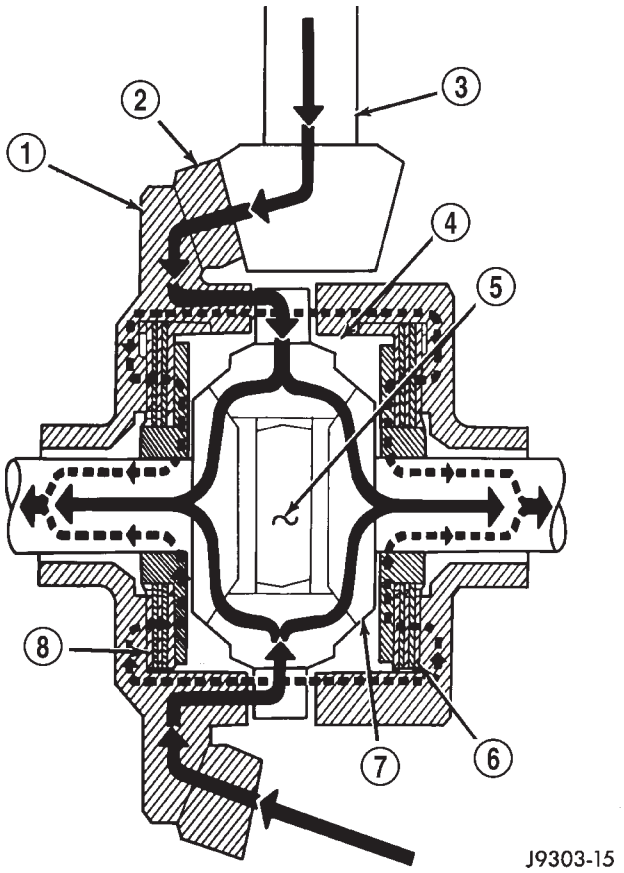


Fig. 7 Trac-lok™ Limited Slip Differential Operation

1 – CASE
2 – RING GEAR
3 – DRIVE PINION
4 – PINION GEAR
5 – MATE SHAFT
6 – CLUTCH PACK
7 – SIDE GEAR
8 – CLUTCH PACK

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:

- Insufficient or incorrect lubricant.
- Foreign matter/water contamination.
- Incorrect bearing preload torque adjustment.
- Incorrect backlash.

Axle gear problem conditions are usually the result of:

- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.

Axle component breakage is most often the result of:

- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.
- Differential housing bores not square to each other.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion companion flange nut.	6. Tighten the pinion companion flange nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Causes	Correction
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored companion flange.	5. Replace companion flange and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then acceler-

DIAGNOSIS AND TESTING (Continued)

ate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak–noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant–pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U–joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out–of–balance wheels.
- Loose wheel lug nuts.
- Worn U–joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion nut.
- Excessive companion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front–end components or engine/transmission mounts. These components can contribute to what appears to be a rear–end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires, for additional vibration information.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U–joints.
- Loose spring mounts.
- Loose pinion nut and companion flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

TRAC–LOK™ DIFFERENTIAL NOISE

The most common problem is a chatter noise when turning corners. Before removing a Trac-lok™ unit for repair, drain, flush and refill the axle with the specified lubricant. Refer to Lubricant change in this Group.

A container of Mopar® Trac-lok™ Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

TRAC–LOK™ TEST

WARNING: WHEN SERVICING VEHICLES WITH A TRAC–LOK™ DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A TRAC–LOK™ AXLE CAN EXERT ENOUGH FORCE IF ONE WHEEL IS IN CONTACT WITH A SURFACE TO CAUSE THE VEHICLE TO MOVE.

DIAGNOSIS AND TESTING (Continued)

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(4) Remove wheel and bolt Special Tool 6790 to studs.

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 8).

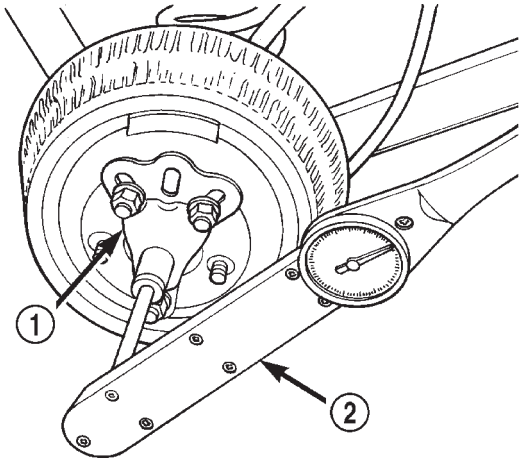


Fig. 8 Trac-lok™ Test —Typical

1 – SPECIAL TOOL 6790 WITH BOLT IN CENTER HOLE
2 – TORQUE WRENCH

(6) If rotating torque is less than 22 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.

SERVICE PROCEDURES

LUBRICANT CHANGE

(1) Raise and support the vehicle.

(2) Remove the lubricant fill hole plug from the differential housing cover.

(3) Remove the differential housing cover and drain the lubricant from the housing.

(4) Clean the housing cavity with a flushing oil, light engine oil, or lint free cloth. **Do not use water, steam, kerosene, or gasoline for cleaning.**

(5) Remove the original sealant from the housing and cover surfaces.

(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 9).

Install the housing cover within 5 minutes after applying the sealant.

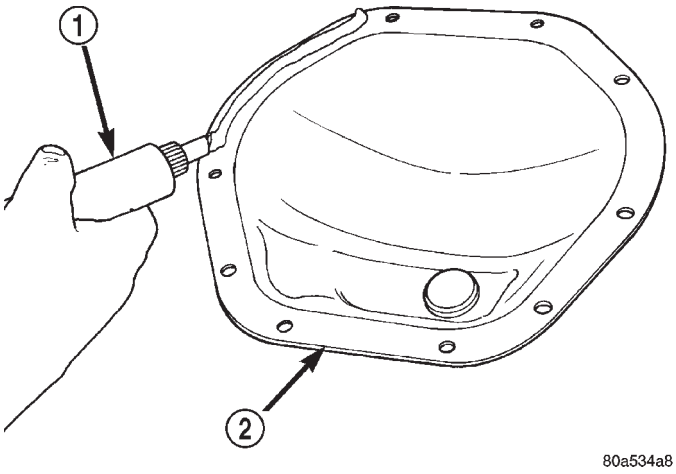


Fig. 9 Apply Sealant

1 – SEALANT
2 – AXLE HOUSING COVER

(7) Install the cover and any identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

(8) For Trac–lok™ differentials, a quantity of Mopar® Trac–lok™ lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.

(9) Fill differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications section of this group for the quantity necessary.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(10) Install the fill hole plug and lower the vehicle.

(11) Trac–lok™ differential equipped vehicles should be road tested by making 10 to 12 slow figure-eight turns. This maneuver will pump the lubricant through the clutch discs to eliminate a possible chatter noise complaint.

REMOVAL AND INSTALLATION

REAR AXLE

REMOVAL

(1) Raise and support the vehicle.

(2) Position a suitable lifting device under the axle.

(3) Secure axle to device.

(4) Remove the wheels and tires.

(5) Secure brake drums to the axle shaft.

(6) Remove the RWAL sensor from the differential housing, if necessary. Refer to Group 5, Brakes, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

(7) Disconnect the brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the wheel cylinders. Refer to Group 5, Brakes, for proper procedures.

(8) Disconnect the parking brake cables and cable brackets.

(9) Disconnect the vent hose from the axle shaft tube.

(10) Mark the propeller shaft and companion flange for installation alignment reference.

(11) Remove propeller shaft.

(12) Disconnect shock absorbers from axle.

(13) Remove the spring clamps and spring brackets. Refer to Group 2, Suspension, for proper procedures.

(14) Separate the axle from the vehicle.

INSTALLATION

(1) Raise the axle with lifting device and align to the leaf spring centering bolts.

(2) Install the spring clamps and spring brackets. Refer to Group 2, Suspension, for proper procedures.

(3) Install shock absorbers and tighten nuts to 82 N·m (60 ft. lbs.) torque.

(4) Install the RWAL sensor to the differential housing, if necessary. Refer to Group 5, Brakes, for proper procedures.

(5) Connect the parking brake cables and cable brackets.

(6) Install the brake drums. Refer to Group 5, Brakes, for proper procedures.

(7) Connect the brake hose to the axle junction block. Refer to Group 5, Brakes, for proper procedures.

(8) Install axle vent hose.

(9) Align propeller shaft and pinion companion flange reference marks. Install the companion flange bolts. Tighten to 108 N·m (80 ft. lbs.) torque.

(10) Install the wheels and tires.

(11) Add gear lubricant, if necessary. Refer to Lubricant Specifications in this section for lubricant requirements.

(12) Remove lifting device from axle and lower the vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.

(2) Remove wheel and tire assembly.

(3) Remove brake drum. Refer to Group 5, Brakes, for proper procedure.

(4) Clean all foreign material from housing cover area.

(5) Loosen housing cover bolts. Drain lubricant from the housing and axle tubes. Remove housing cover.

(6) Rotate differential case so that pinion mate shaft lock screw is accessible. Remove lock screw and pinion mate shaft from differential case (Fig. 10).

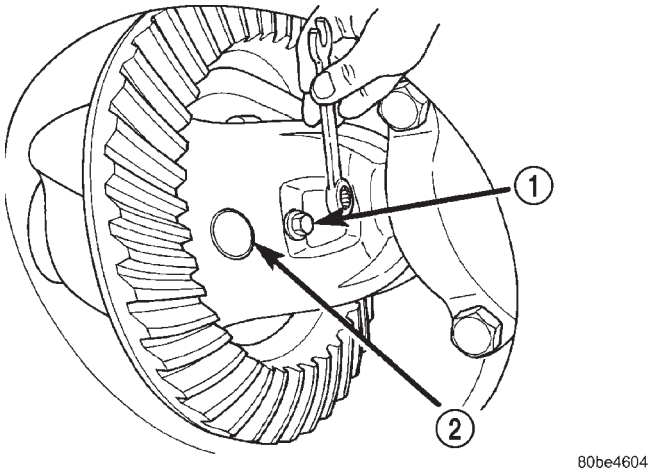


Fig. 10 Pinion Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION MATE SHAFT

(7) Push axle shaft inward and remove axle shaft C–lock from the axle shaft (Fig. 11).

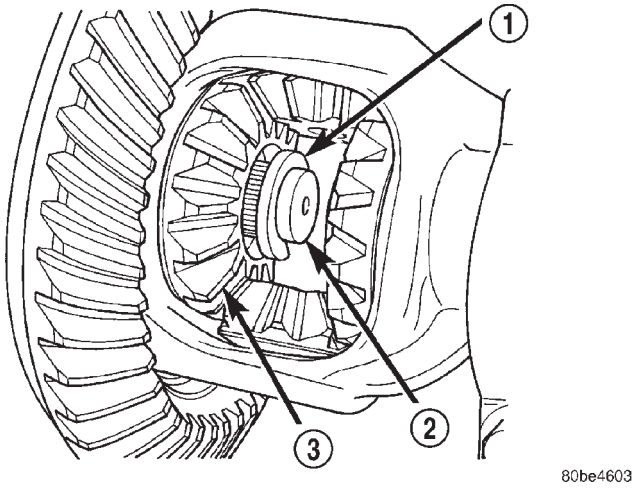


Fig. 11 Axle Shaft C–Lock

1 – C—LOCK
2 – AXLE SHAFT
3 – SIDE GEAR

(8) Remove axle shaft. Use care to prevent damage to axle shaft bearing and seal, which will remain in axle tube.

(9) Inspect axle shaft seal for leakage or damage.

(10) Inspect roller bearing contact surface on axle shaft for signs of brinelling, galling and pitting. If

REMOVAL AND INSTALLATION (Continued)

any of these conditions exist, the axle shaft and/or bearing and seal must be replaced.

INSTALLATION

(1) Lubricate bearing bore and seal lip with gear lubricant. Insert axle shaft through seal, bearing, and engage it into side gear splines.

NOTE: Use care to prevent shaft splines from damaging axle shaft seal lip.

(2) Insert C–lock in end of axle shaft. Push axle shaft outward to seat C–lock in side gear.

(3) Insert pinion shaft into differential case and through thrust washers and differential pinions.

(4) Align hole in shaft with hole in the differential case and install lock screw with Loctite® on the threads. Tighten lock screw to 11 N·m (8 ft. lbs.) torque.

(5) Install cover and add fluid. Refer to Lubricant Change procedure in this section for procedure and lubricant requirements.

(6) Install brake drum. Refer to Group 5, Brakes, for proper procedures.

(7) Install wheel and tire.

(8) Lower vehicle.

8 1/4 AND 9 1/4 AXLE SEAL AND BEARING

REMOVAL

(1) Remove axle shaft.

(2) Remove axle shaft seal from the end of the axle tube with a small pry bar (Fig. 12).

NOTE: The seal and bearing can be removed at the same time with the bearing removal tool.

(3) Remove the axle shaft bearing from the axle tube with Bearing Removal Tool Set 6310, using Adapter Foot 6310-9 (Fig. 13).

INSTALLATION

NOTE: Do not install the original axle shaft seal. Always install a new seal.

(1) Wipe the axle tube bore clean. Remove any old sealer or burrs from the tube.

(2) Install the axle shaft bearing with Installer C-4198 and Handle C-4171 (Fig. 14). Ensure that the bearing part number is against the installer. Verify that the bearing in installed straight and the tool fully contacts the axle tube when seating the bearing.

(3) Install a new axle seal with Installer C-4076-B and Handle C-4735-1. When the tool contacts the axle tube, the seal is installed to the correct depth.

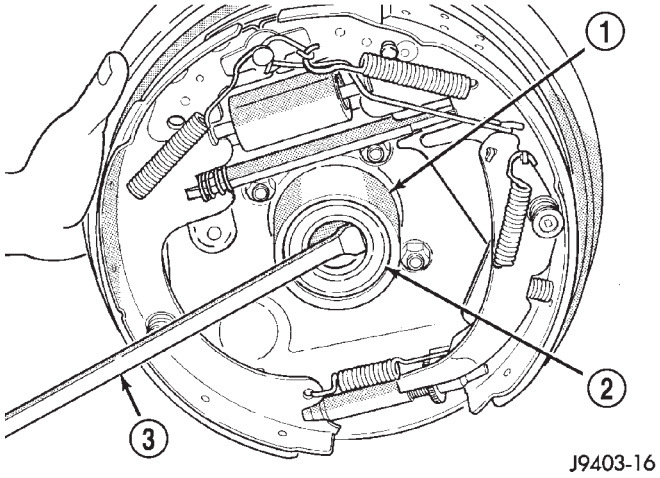


Fig. 12 Axle Seal Removal

1 – AXLE TUBE
2 – AXLE SEAL
3 – PRY BAR

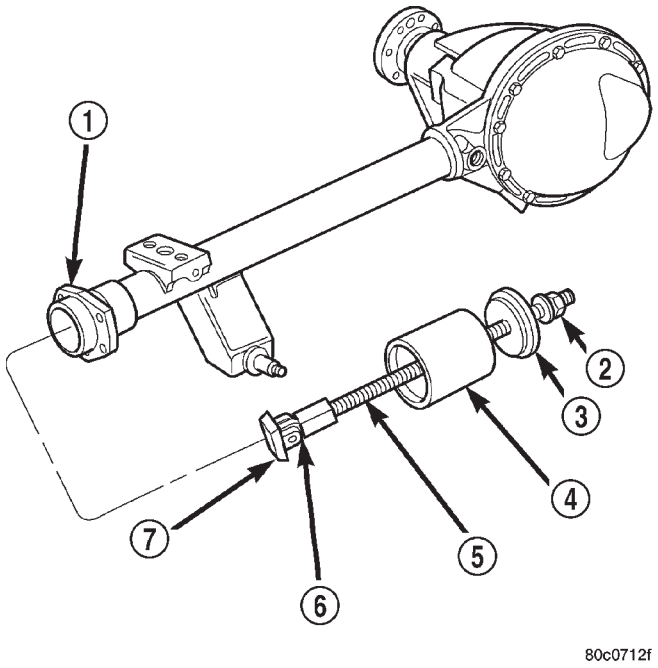


Fig. 13 Axle Shaft Bearing Removal Tool

1 – AXLE SHAFT TUBE
2 – NUT
3 – GUIDE PLATE
4 – GUIDE
5 – THREADED ROD
6 – ADAPTER
7 – FOOT

(4) Coat the lip of the seal with axle lubricant for protection prior to installing the axle shaft.

(5) Install the axle shaft.

REMOVAL AND INSTALLATION (Continued)

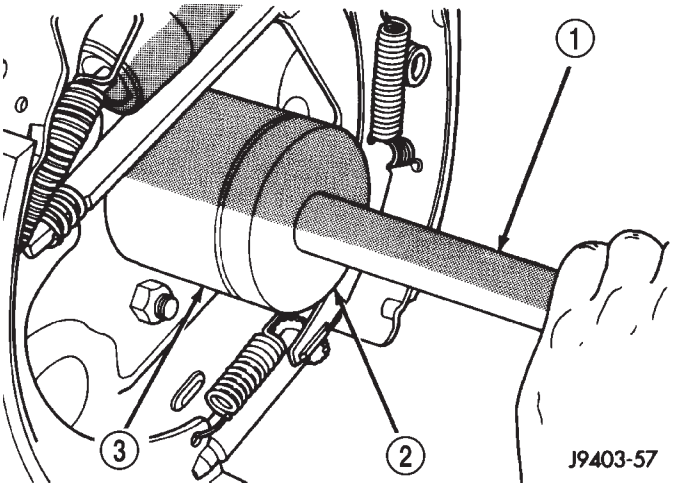


Fig. 14 Axle Shaft Seal and Bearing Installation

1 – HANDLE
2 – INSTALLER
3 – AXLE TUBE

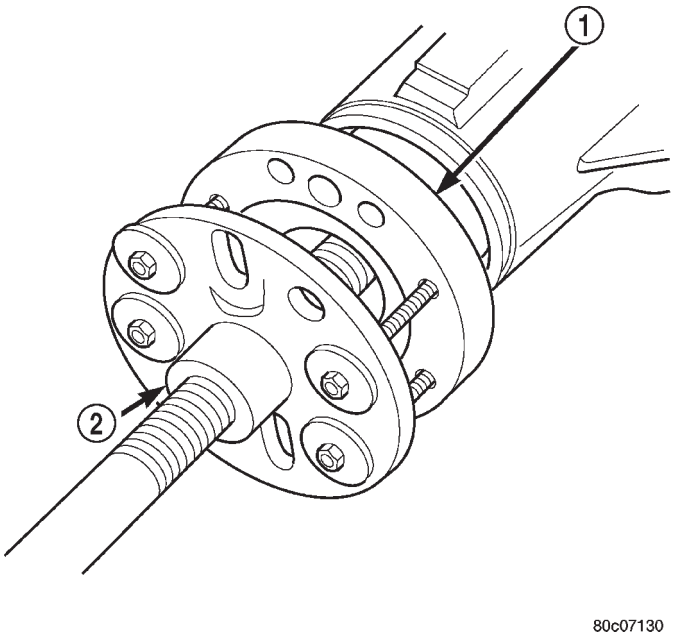


Fig. 15 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

PINION SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Scribe a mark on the universal joint, companion flange, and pinion shaft for installation reference.

(3) Disconnect the propeller shaft from the companion flange. Secure the propeller shaft in an upright position to prevent damage to the rear universal joint.

(4) Remove the wheel and tire assemblies.

(5) Remove the brake drums to prevent any drag. The drag may cause a false bearing preload torque measurement.

(6) Rotate the companion flange three or four times.

(7) Measure the amount of torque necessary to rotate the pinion with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(9) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(10) Hold the flange with Holder 6719. Remove the pinion nut and washer.

(11) Remove the companion flange with Remover C-452 (Fig. 15).

(12) Remove the pinion seal with suitable pry tool or slide-hammer mounted screw.

INSTALLATION

(1) Clean the seal contact surface in the housing bore.

(2) Examine the splines on the pinion shaft for burrs or wear. Remove any burrs and clean the shaft.

(3) Inspect companion flange for cracks, worn splines and worn seal contact surface. Replace companion flange if necessary.

NOTE: The outer perimeter of the seal is pre-coated with a special sealant. An additional application of sealant is not required.

(4) Apply a light coating of gear lubricant on the lip of pinion seal.

(5) Install the new pinion seal with Installer C-4076-B and Handle C-4735-1 for 8 1/4 axles (Fig. 16) and Installer C-3860-A and Handle C-4171 for 9 1/4 axles.

NOTE: The seal is correctly installed when the seal flange contacts the face of the differential housing.

(6) Position the companion flange on the end of the shaft with the reference marks aligned.

(7) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(8) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(9) Seat companion flange on pinion shaft with Installer C-3718 and Holder 6719.

REMOVAL AND INSTALLATION (Continued)

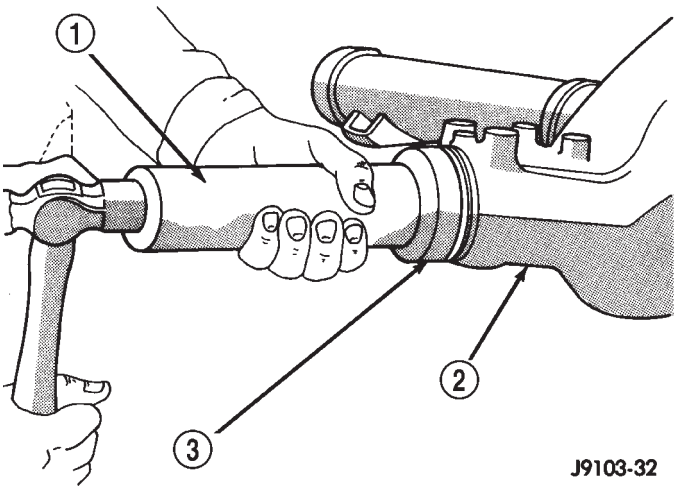


Fig. 16 8 1/4 Axle Pinion Seal Installation

1 – SPECIAL TOOL C-4735
2 – DIFFERENTIAL HOUSING
3 – SPECIAL TOOL C-4076-A

(10) Remove the Installer C-3718 and install the pinion washer and a new pinion nut. The convex side of the washer must face outward.

CAUTION: Do not exceed the minimum tightening torque when installing the companion flange retaining nut at this point. Damage to collapsible spacer or bearings may result.

(11) Hold companion flange with Holder 6719 and tighten the pinion nut to 285 N·m (210 ft. lbs.) (Fig. 17). Rotate pinion several revolutions to ensure the bearing rollers are seated.

(12) Rotate the pinion using an (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 18).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If rotating torque is exceeded, a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(13) If the rotating torque is low, use Holder 6719 to hold the companion flange (Fig. 17) and tighten the pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

NOTE: The bearing rotating torque should be constant during a complete revolution of the pinion. If the rotating torque varies, this indicates a binding condition.

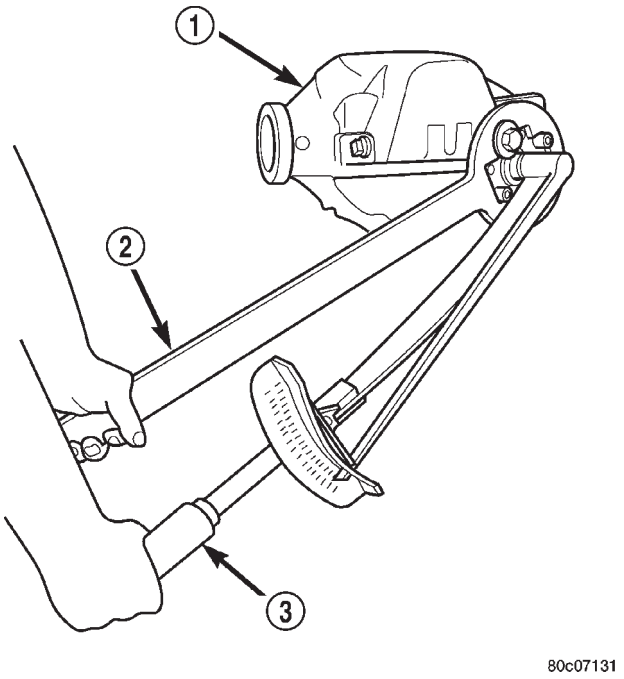


Fig. 17 Tightening Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

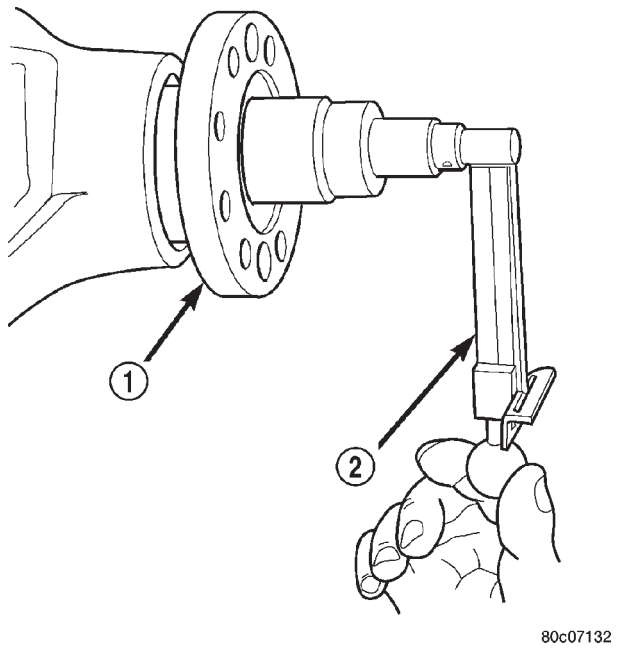


Fig. 18 Check Pinion Rotation Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

REMOVAL AND INSTALLATION (Continued)

(14) The seal replacement is unacceptable if the final pinion nut torque is less than 285 N·m (210 ft. lbs.).

(15) Install the propeller shaft with the installation reference marks aligned.

(16) Tighten the companion flange bolts to 108 N·m (80 ft. lbs.).

(17) Install the brake drums.

(18) Install wheel and tire assemblies and lower the vehicle.

(19) Check the differential housing lubricant level.

DIFFERENTIAL

REMOVAL

(1) Remove the axle shafts.

(2) Remove RWAL/ABS sensor from housing.

NOTE: Side play resulting from bearing races being loose on case hubs requires replacement of the differential case.

(3) Mark the differential housing and the differential bearing caps for installation reference (Fig. 19).

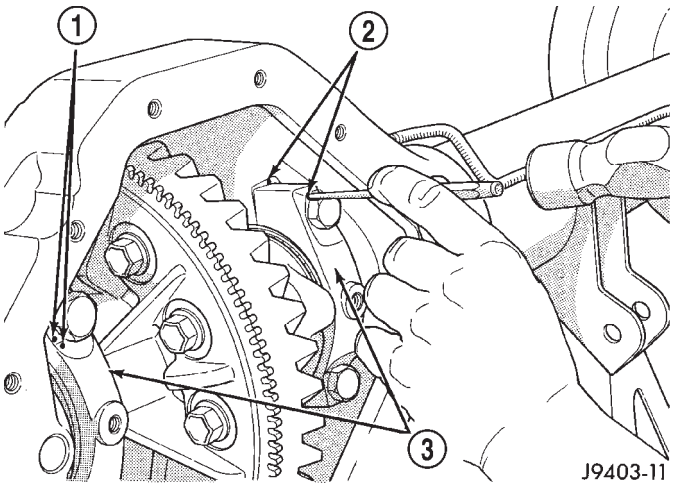


Fig. 19 Mark For Installation Reference

1 – REFERENCE MARKS
2 – REFERENCE MARK
3 – BEARING CAPS

(4) Remove bearing threaded adjuster lock from each bearing cap. Loosen the bolts, but do not remove the bearing caps.

(5) Loosen the threaded adjusters with Wrench C-4164 (Fig. 20).

(6) Hold the differential case while removing bearing caps and adjusters.

(7) Remove the differential case.

NOTE: Each differential bearing cup and threaded adjuster must be kept with their respective bearing.

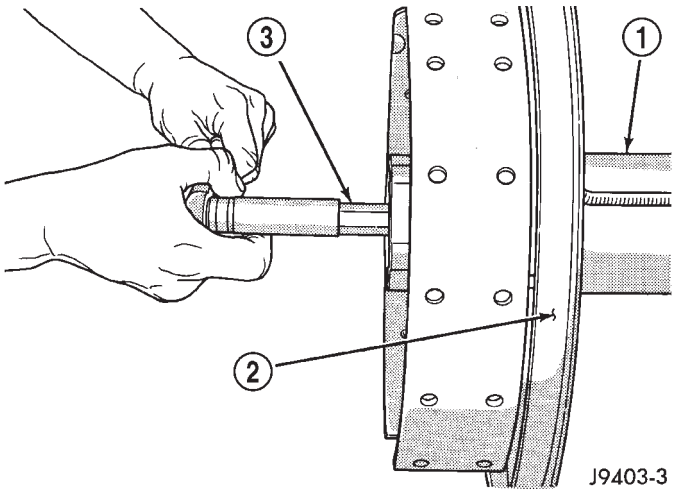


Fig. 20 Threaded Adjuster Tool

1 – AXLE TUBE
2 – BACKING PLATE
3 – TOOL C-4164

INSTALLATION

(1) Apply a coating of hypoid gear lubricant to the differential bearings, bearing cups, and threaded adjusters. A dab of grease can be used to keep the adjusters in position. Carefully position the assembled differential case in the housing.

(2) Observe the reference marks and install the differential bearing caps at their original locations (Fig. 21).

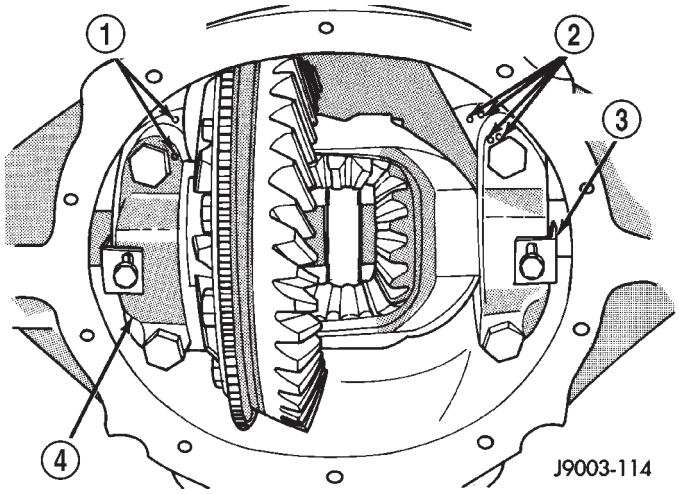


Fig. 21 Bearing Caps & Bolts

1 – INSTALLATION REFERENCE MARKS
2 – INSTALLATION REFERENCE MARKS
3 – ADJUSTER LOCK
4 – BEARING CAP

(3) Install bearing cap bolts and tighten the upper bolts to 14 N·m (10 ft. lbs.). Tighten the lower bolts finger-tight until the bolt head is seated.

REMOVAL AND INSTALLATION (Continued)

(4) Perform the differential bearing preload and adjustment procedure.

NOTE: Be sure that all bearing cap bolts are tightened to their final torque of 136 N·m (100 ft.lbs.) before proceeding.

(5) Install axle shafts and differential housing cover.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA and:

- Adapters C-293-48 and Plug SP-3289 for the 8 1/4 axle (Fig. 22).
- Adapters C-293-47 and Plug C-293-3 for the 9 1/4 axle (Fig. 23).

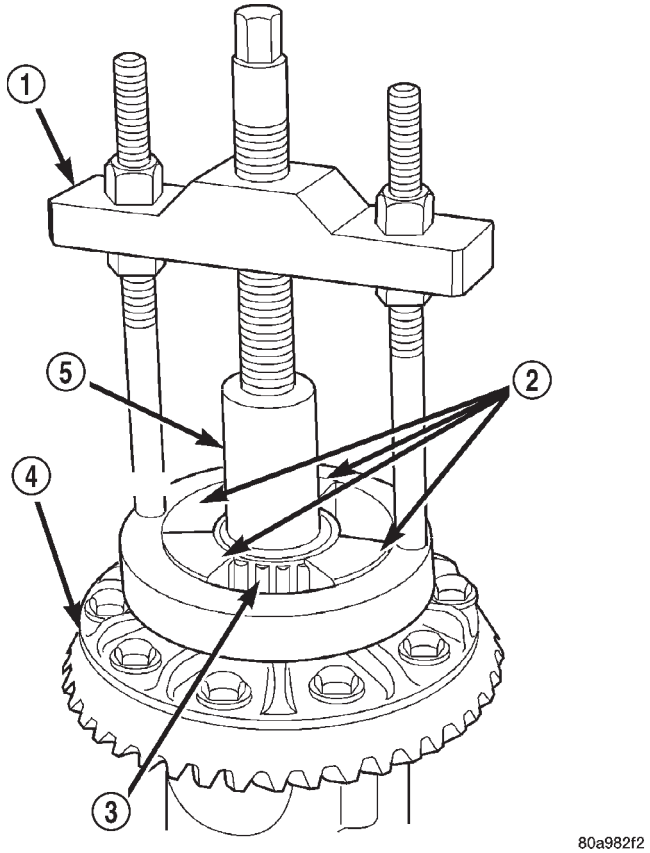


Fig. 22 Differential Bearing Removal—8 1/4 Axle

1 – SPECIAL TOOL C-293–PA
2 – SPECIAL TOOL C-293–48
3 – BEARING
4 – DIFFERENTIAL
5 – SPECIAL TOOL SP-3289

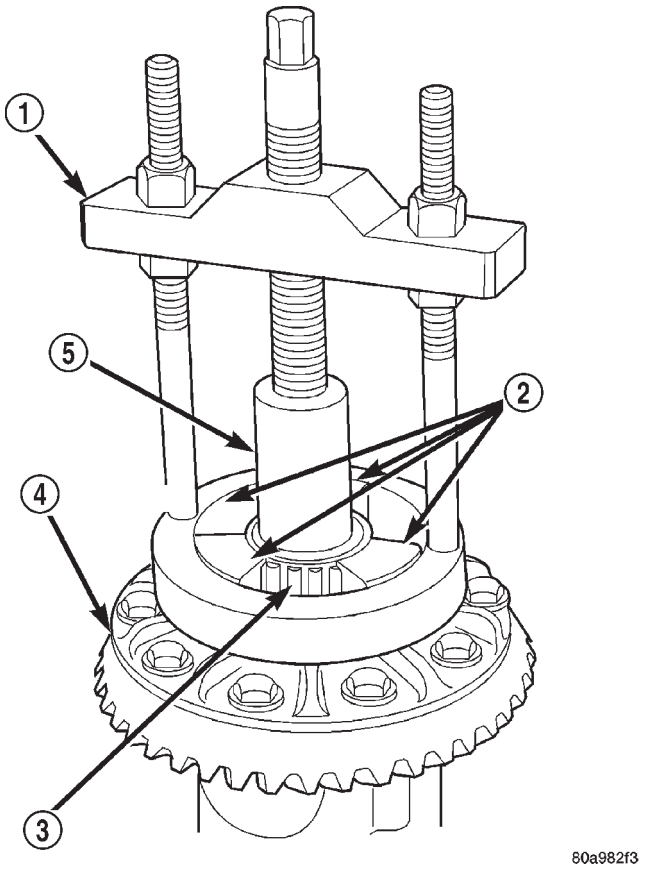


Fig. 23 Differential Bearing Removal—9 1/4 Axle

1 – SPECIAL TOOL C-293–PA
2 – SPECIAL TOOL C-293–47
3 – BEARING
4 – DIFFERENTIAL
5 – SPECIAL TOOL C-293–3

INSTALLATION

(1) Install differential side bearings. Use:

- Installer C-4340 with handle C-4171 for the 8 1/4 axle (Fig. 24).
- Installer C-4213 and Handle C-4171 for the 9 1/4 axle.

(2) Install differential case in axle housing.

RING GEAR AND EXCITER RING

NOTE: The ring gear and pinion are serviced in a matched set. Do not replace the ring gear without replacing the pinion.

REMOVAL AND INSTALLATION (Continued)

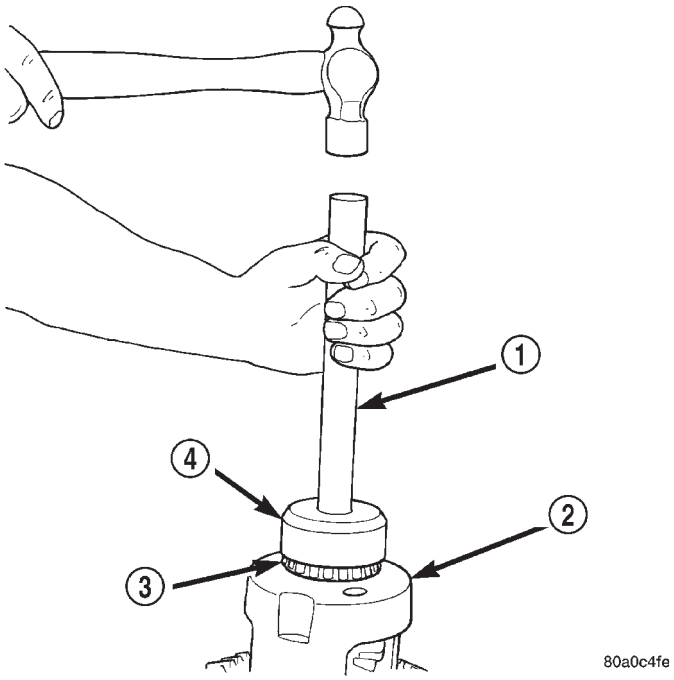


Fig. 24 Install Differential Side Bearings—8 1/4 Axle

1 – HANDLE C-4171
2 – DIFFERENTIAL
3 – BEARING
4 – TOOL C-4340

REMOVAL

(1) Remove differential from axle housing.

(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 25).

(3) Remove bolts holding ring gear to differential case.

(4) Using a soft hammer, drive ring gear from differential case (Fig. 25).

(5) Use a brass drift and slowly tap the exciter ring from the differential case.

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

(1) Invert the differential case.

(2) Position exciter ring on differential case.

(3) Using a brass drift, slowly and evenly tap the exciter ring into position.

(4) Position ring gear on the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(5) Invert the differential case in the vise.

(6) Install new ring gear bolts and alternately tighten to:

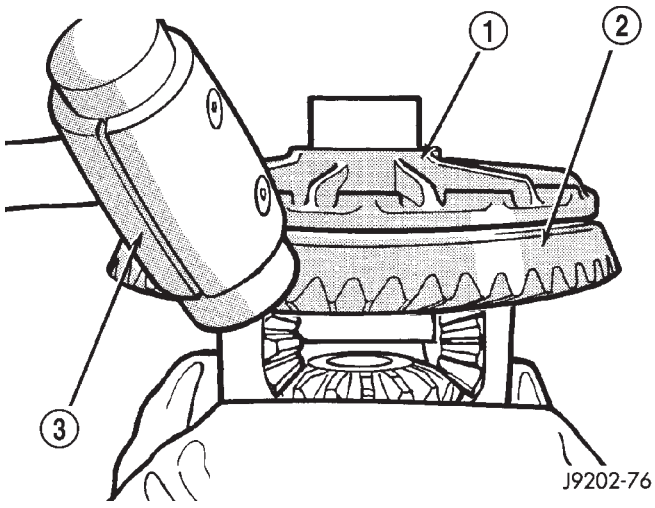


Fig. 25 Ring Gear Removal

1 – CASE
2 – RING GEAR
3 – RAWHIDE HAMMER

- 102 N·m (75 ft. lbs.) torque (Fig. 26) for 8 1/4 axles.
- 157 N·m (115 ft. lbs.) torque (Fig. 26) for 9 1/4 axles.

(7) Install differential in axle housing and verify gear mesh and contact pattern.

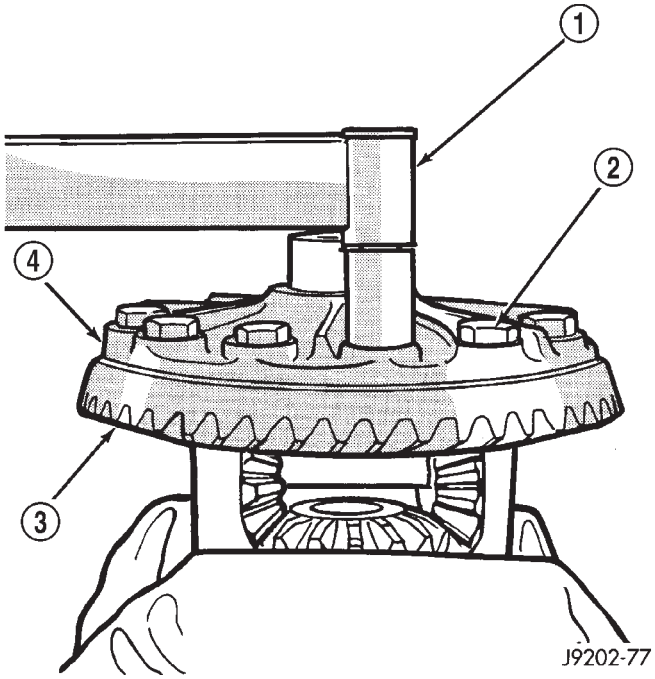


Fig. 26 Ring Gear Bolt Installation

1 – TORQUE WRENCH
2 – RING GEAR BOLT
3 – RING GEAR
4 – CASE

REMOVAL AND INSTALLATION (Continued)

PINION GEAR

NOTE: The ring gear and pinion are serviced in a matched set. Do not replace the pinion without replacing the ring gear.

REMOVAL

(1) Remove differential from the axle housing.
(2) Mark the companion flange and propeller shaft for installation alignment.
(3) Disconnect the propeller shaft from the companion flange. Using suitable wire, tie propeller shaft to underbody.
(4) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.
(5) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.
(6) Use Holder 6719 to hold companion flange and remove the companion flange nut and washer.
(7) Using Remover C–452, remove the companion flange from the pinion (Fig. 27).

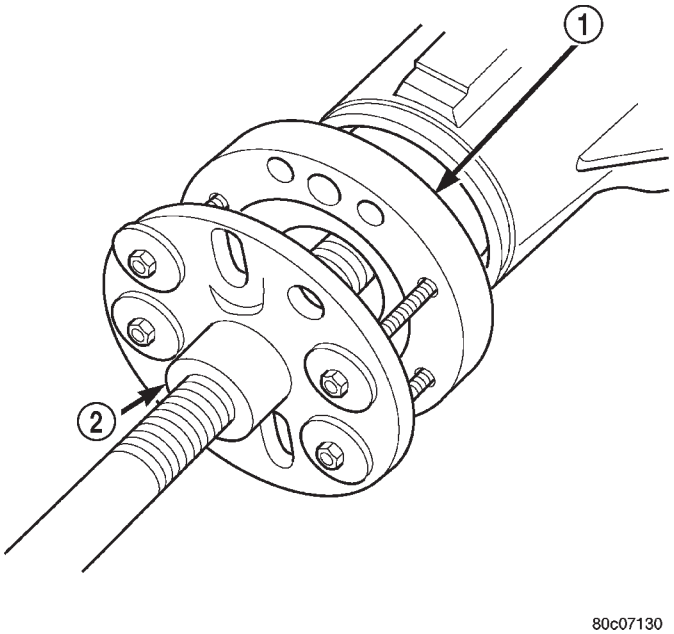


Fig. 27 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

(8) Partially install pinion nut onto pinion to protect the threads.
(9) Remove the pinion from housing (Fig. 28). Catch the pinion with your hand to prevent it from falling and being damaged.
(10) Remove the pinion shaft seal with suitable pry tool or slide-hammer mounted screw.

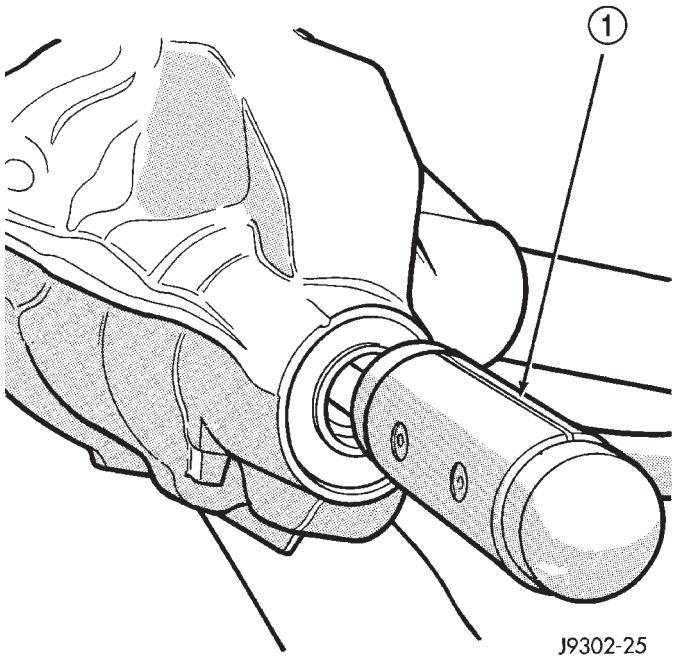


Fig. 28 Remove Pinion

1 – RAWHIDE HAMMER

(11) Remove oil slinger, if equipped, and front pinion bearing.
(12) Remove the front pinion bearing cup with:
• Remover C-4345 and Handle C–4171 for the 8 1/4 axles (Fig. 29).
• Bearing Removal Tool Set 6310 and Adapter Foot 6310-9 for the 9 1/4 axles.

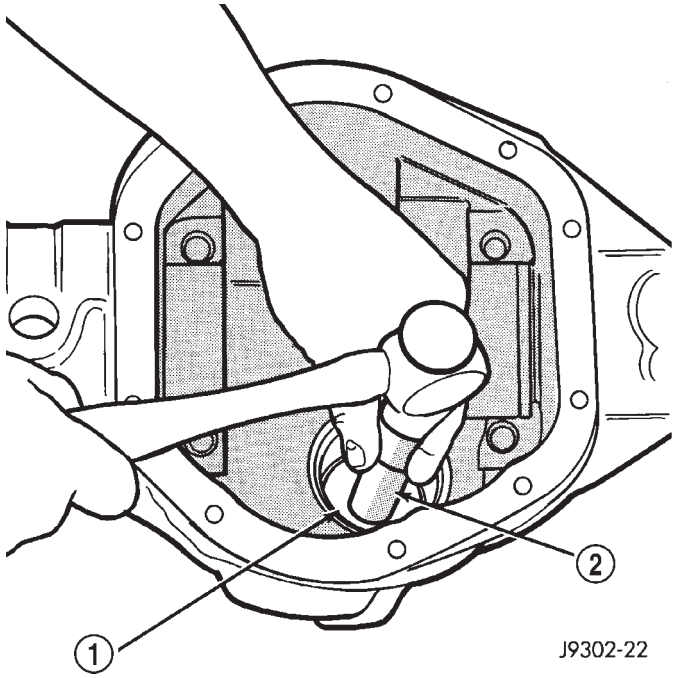


Fig. 29 Front Bearing Cup Removal

1 – REMOVER
2 – HANDLE

REMOVAL AND INSTALLATION (Continued)

(13) Remove the rear bearing cup from housing (Fig. 30). Use:

- Remover C-4307 and Handle C–4171 for the 8 1/4 axle.
- Remover C-4309 and Handle C-4171 for the 9 1/4 axle.

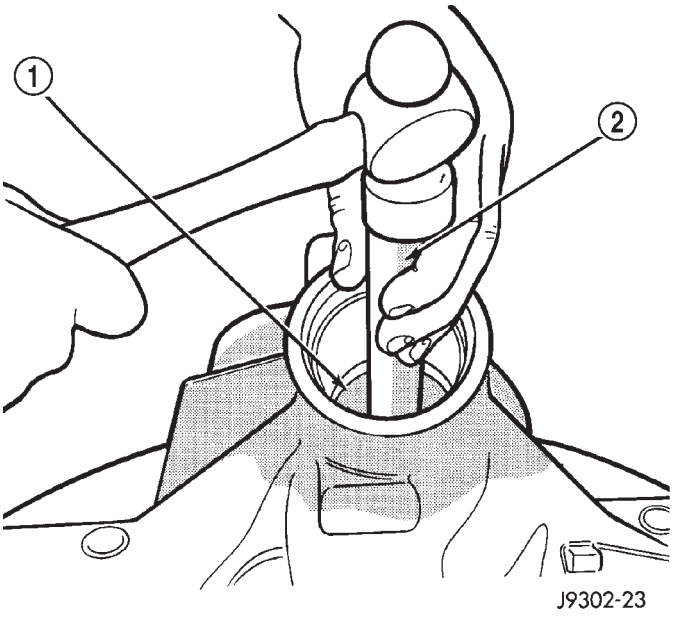


Fig. 30 Rear Bearing Cup Removal

1 – DRIVER
2 – HANDLE

(14) Remove the collapsible preload spacer (Fig. 31).

(15) Remove the rear bearing from the pinion (Fig. 32) with:

- Puller/Press C-293-PA and Adapters C-293-47 for the 8 1/4 axle.
- Puller/Press C-293-PA and Adapters C-293-37 for the 9 1/4 axle.

Place 4 adapter blocks so they do not damage the bearing cage.

(16) Remove the depth shims from the pinion shaft. Record the thickness of the depth shims.

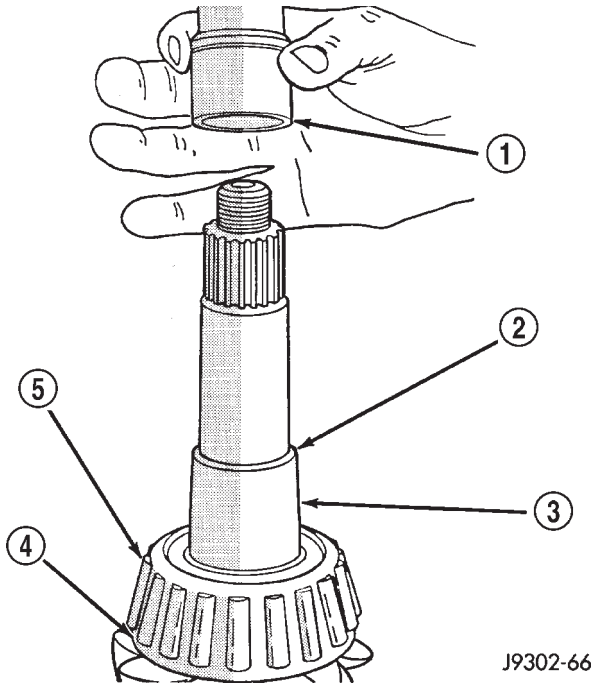


Fig. 31 Collapsible Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION GEAR
4 – OIL SLINGER
5 – REAR BEARING

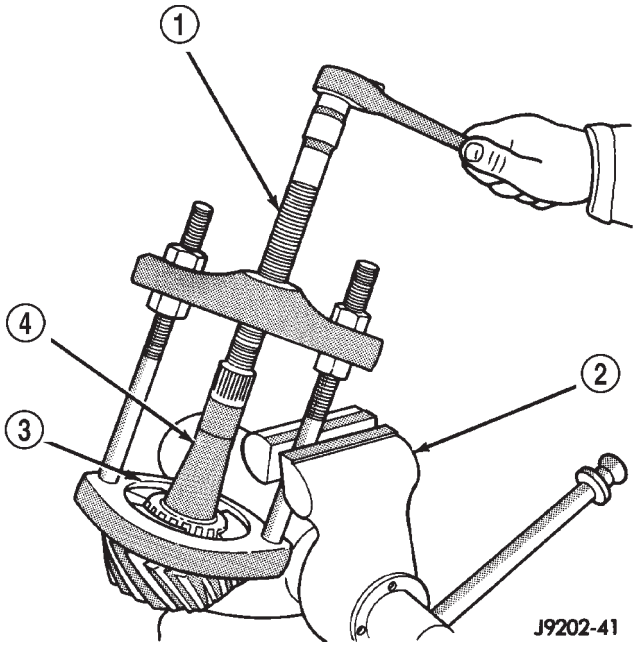


Fig. 32 Rear Bearing Removal

1 – SPECIAL TOOL C-293–PA
2 – VISE
3 – ADAPTERS
4 – DRIVE PINION GEAR SHAFT

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(2) Install the pinion rear bearing cup (Fig. 33) with:

- Installer C-4308 and Driver Handle C–4171 for the 8 1/4 axle.
- Installer C-4310 and Driver Handle C–4171 for the 9 1/4 axle.

(2) Ensure cup is correctly seated.

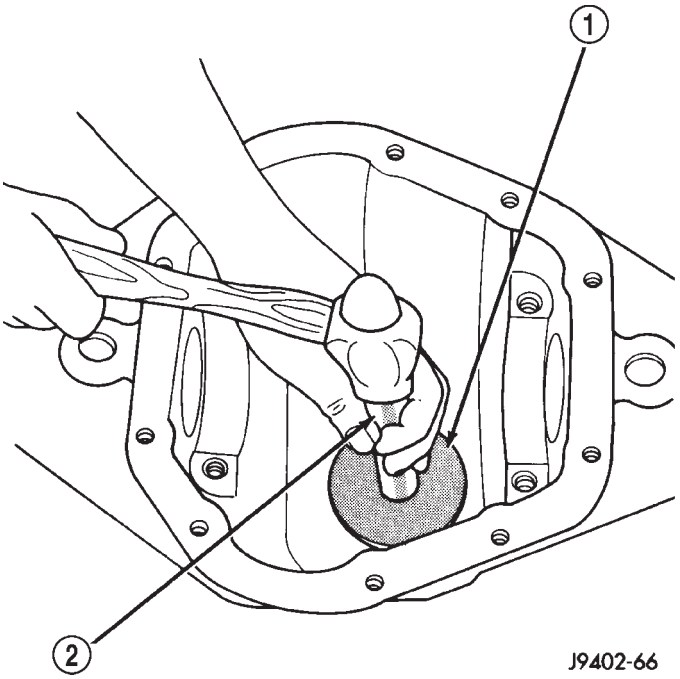


Fig. 33 Pinion Rear Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(4) Install the pinion front bearing cup (Fig. 34) with:

- Installer D–130 and Handle C–4171 for the 8 1/4 axle.
- Installer D–129 and Handle C–4171 for the 9 1/4 axle.

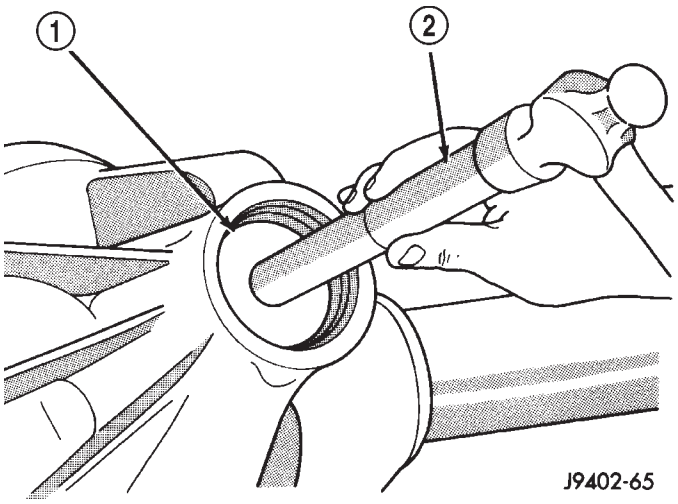


Fig. 34 Pinion Front Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

(5) Install pinion front bearing, and oil slinger, if equipped.

(6) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with:

- Installer C-4076–B and Handle C-4735-1 for the 8 1/4 axle (Fig. 35).
- Installer C-3860-A and Handle C-4171 for the 9 1/4 axle.

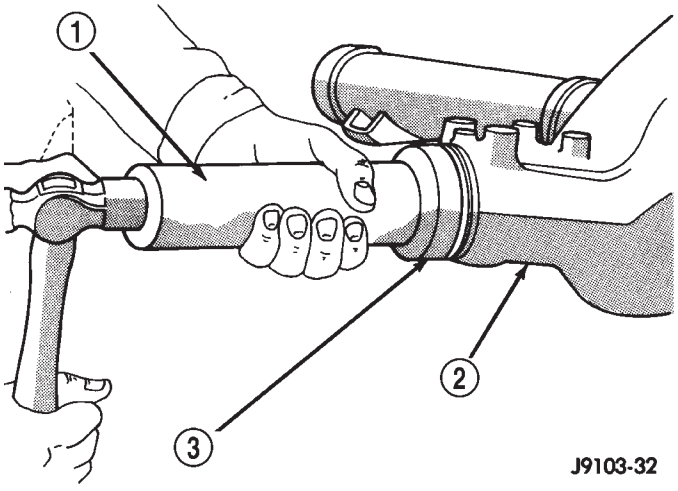


Fig. 35 Pinion Seal Installation—8 1/4 Axle

1 – SPECIAL TOOL C-4735
2 – DIFFERENTIAL HOUSING
3 – SPECIAL TOOL C-4076-A

REMOVAL AND INSTALLATION (Continued)

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion head to achieve proper ring gear and pinion mesh. If the factory installed ring gear and pinion are reused, the pinion depth shim should not require replacement. If required, refer to Pinion Gear Depth to select the proper thickness shim before installing rear pinion bearing.

(7) Place the proper thickness depth shim on the pinion shaft.

(8) Install the rear bearing and slinger, if equipped, on the pinion (Fig. 36) with:

- Installer 6448 for the 8 1/4 axle.
- Installer C-3095 for the 9 1/4 axle.

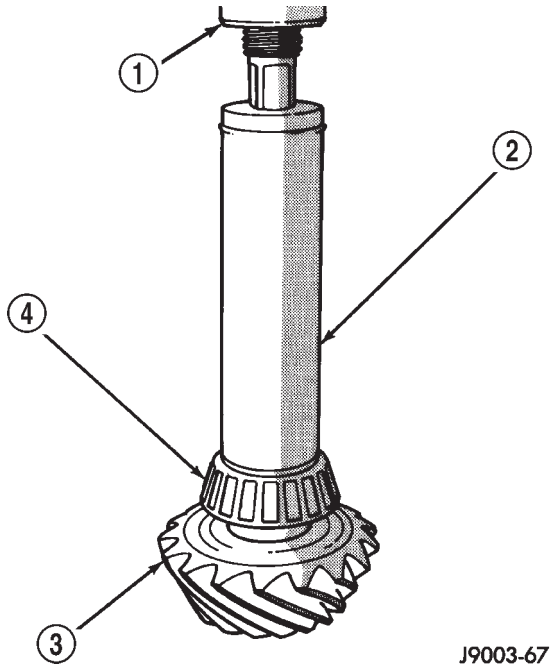


Fig. 36 Shaft Rear Bearing Installation

1 – PRESS
2 – INSTALLATION TOOL
3 – DRIVE PINION GEAR
4 – DRIVE PINION GEAR SHAFT REAR BEARING

(9) Install a new collapsible preload spacer on pinion shaft and install the pinion in the housing (Fig. 37).

(10) Install the pinion in housing.

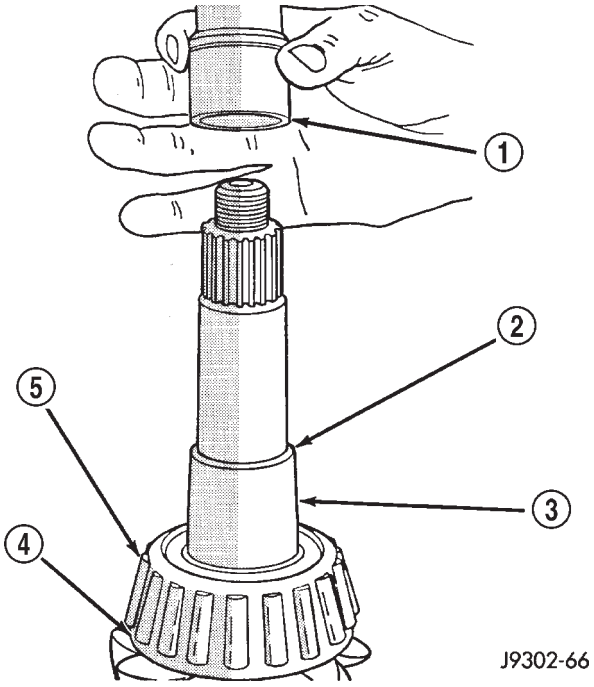


Fig. 37 Collapsible Preload Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION GEAR
4 – OIL SLINGER
5 – REAR BEARING

(11) Install the companion flange with Installer C-3718 and Holder 6719.

(12) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(13) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(14) Install the companion flange washer and a new nut on the pinion and tighten the pinion nut until there is zero bearing end-play. It will not be possible at this point to achieve zero bearing end-play if a new collapsible spacer was installed.

REMOVAL AND INSTALLATION (Continued)

(15) Tighten the nut to 285 N·m (210 ft. lbs.) (Fig. 38).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

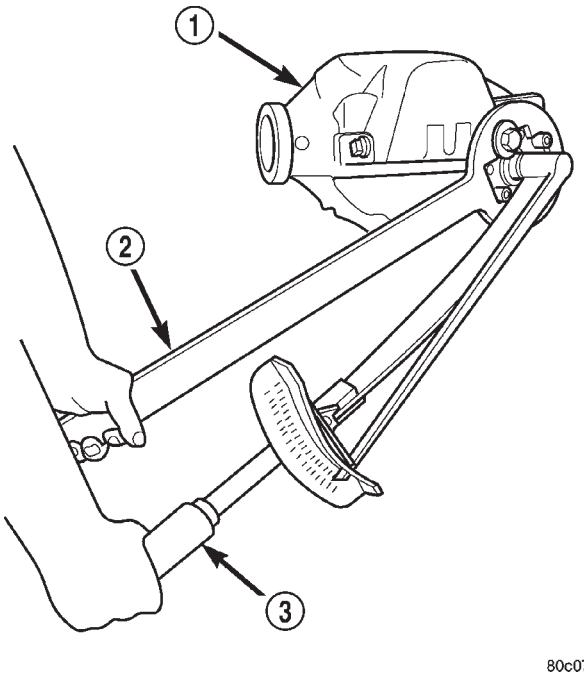


Fig. 38 Tighten the Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

(16) Using Holder 6719, crush collapsible spacer until bearing end play is taken up.

(17) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 39).

(18) Check bearing rotating torque with an inch pound torque wrench (Fig. 39). The torque necessary to rotate the pinion should be:

- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(19) Install propeller shaft.

(20) Install differential in housing.

FINAL ASSEMBLY

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, on the housing cover (Fig. 40).

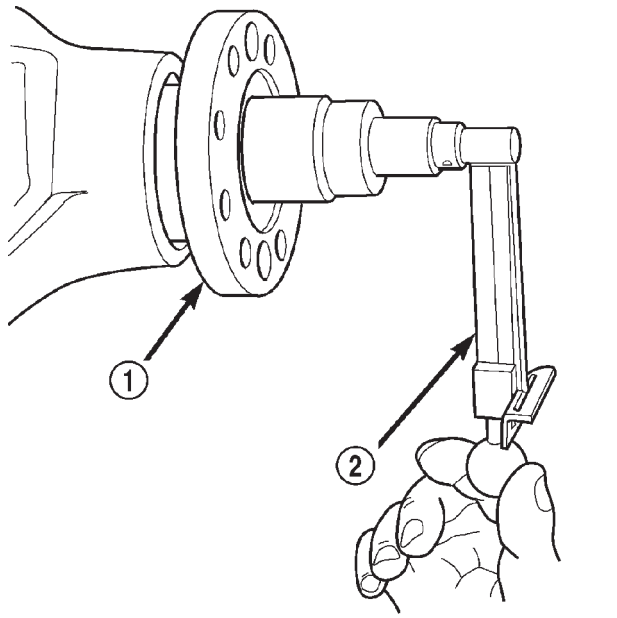


Fig. 39 Check pinion Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

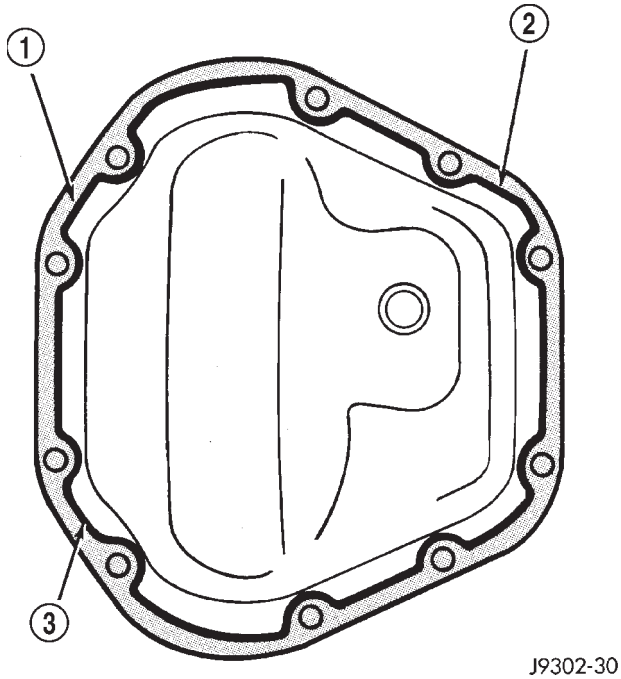


Fig. 40 Typical Housing Cover With Sealant

1 – SEALING SURFACE
2 – CONTOUR OF BEAD
3 – BEAD THICKNESS 6.35MM (1/4")

Install the housing cover within 5 minutes after applying the sealant.

REMOVAL AND INSTALLATION (Continued)

(2) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.
(4) Install the fill hole plug.

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove pinion mate shaft lock screw (Fig. 41).
(2) Remove pinion mate shaft.
(3) Rotate the differential side gears and remove the differential pinion gears and thrust washers (Fig. 42).

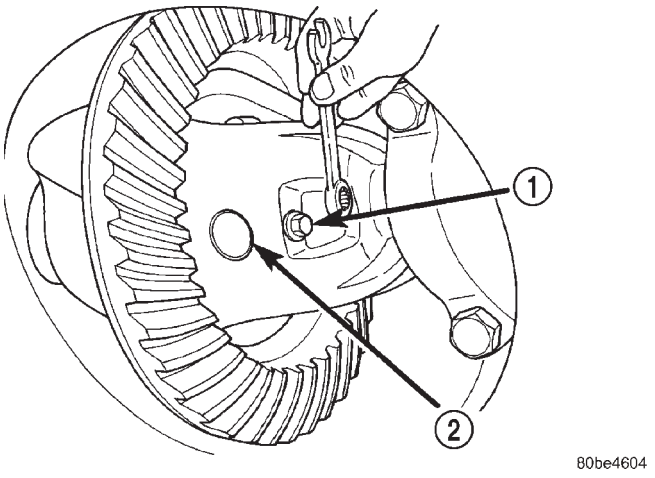


Fig. 41 Pinion Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION MATE SHAFT

(4) Remove the differential side gears and thrust washers.

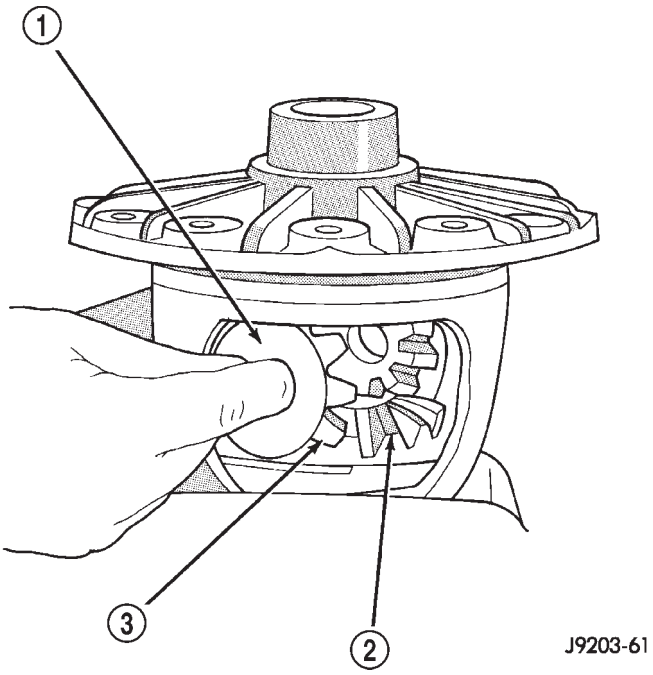


Fig. 42 Pinion Mate Gear Removal

1 – THRUST WASHER
2 – SIDE GEAR
3 – PINION MATE GEAR

ASSEMBLY

(1) Install the differential side gears and thrust washers.
(2) Install the differential pinion gears and thrust washers.
(3) Install the pinion mate shaft.
(4) Align the hole in the pinion mate shaft with the hole in the differential case and install the pinion mate shaft lock screw.
(5) Lubricate all differential components with hypoid gear lubricant.

8 1/4 TRAC-LOK™ DIFFERENTIAL

The Trac–lok™ differential components are illustrated in (Fig. 43). Refer to this illustration during repair service.

DISASSEMBLY AND ASSEMBLY (Continued)

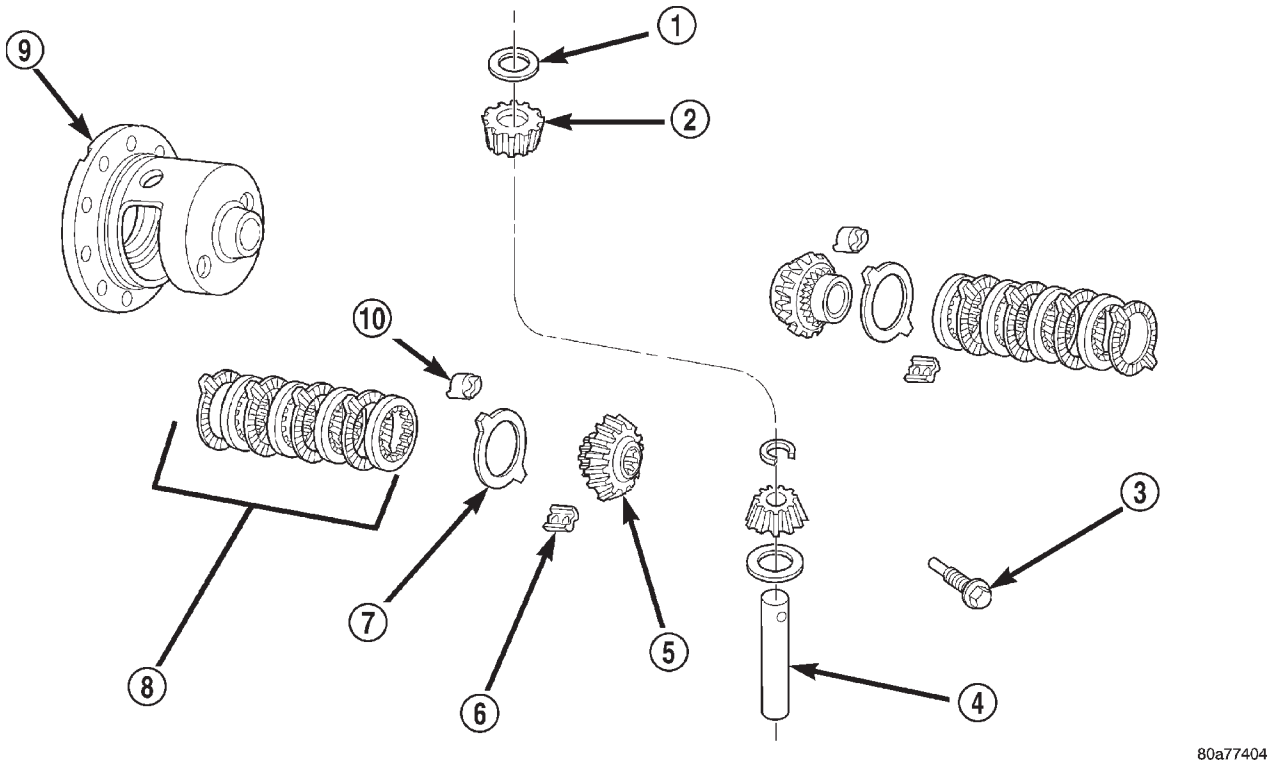


Fig. 43 Trac–lok™ Differential Components

1 – THRUST WASHER
2 – PINION
3 – SHAFT LOCK SCREW
4 – PINION MATE SHAFT
5 – SIDE GEAR
6 – RETAINER
7 – DISC
8 – CLUTCH PACK
9 – DIFFERENTIAL CASE
10 – RETAINER

DISASSEMBLY

(1) Clamp Side Gear Holding Tool 8138 in a vise.

(2) Position the differential case on Side Gear Holding Tool 8138 (Fig. 44).

(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-lok™ differential can be serviced with the ring gear installed.

(4) Remove the pinion gear mate shaft lock screw (Fig. 45).

(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 46).

(6) Install and lubricate Step Plate 8140–2 (Fig. 47).

(7) Assemble Threaded Adapter 8140-1 into top side gear. Thread Forcing Screw 6960-4 into adapter until it becomes centered in adapter plate.

DISASSEMBLY AND ASSEMBLY (Continued)

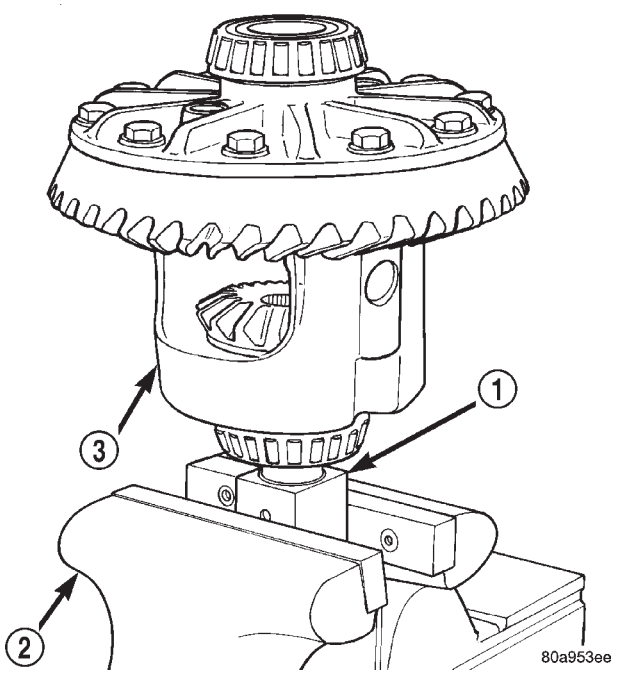


Fig. 44 Differential Case Holding Tool

1 – SIDE GEAR HOLDING TOOL
2 – VISE
3 – DIFFERENTIAL

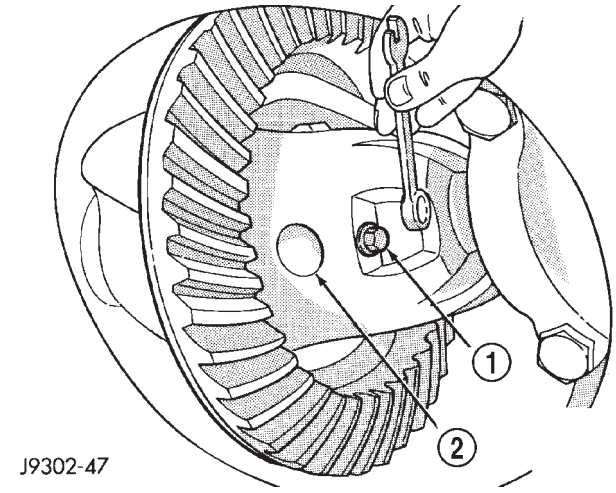


Fig. 45 Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION GEAR MATE SHAFT

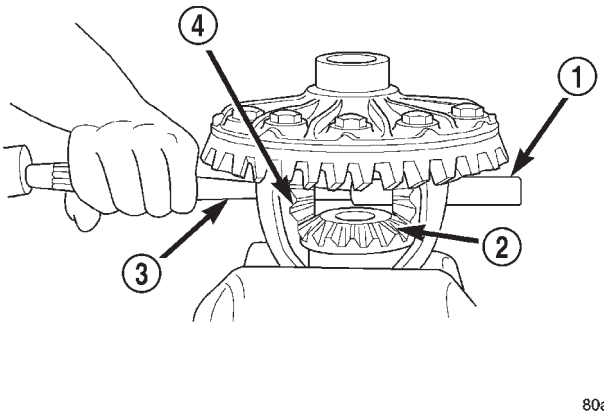


Fig. 46 Mate Shaft Removal

1 – PINION MATE SHAFT
2 – SIDE GEAR
3 – DRIFT
4 – PINION MATE GEAR

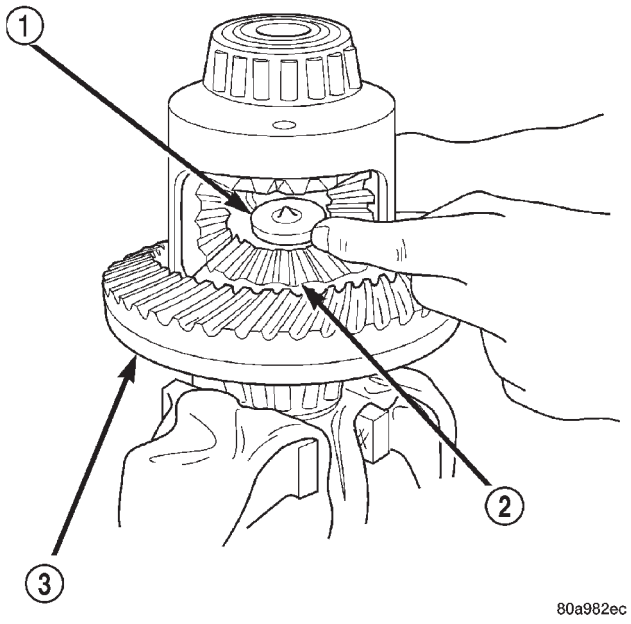


Fig. 47 Step Plate Tool Installation

1 – SPECIAL TOOL 8140–2
2 – LOWER SIDE GEAR
3 – DIFFERENTIAL CASE

(8) Position a small screw driver in slot of Threaded Adapter 8140-1 (Fig. 48) to prevent adapter from turning.

DISASSEMBLY AND ASSEMBLY (Continued)

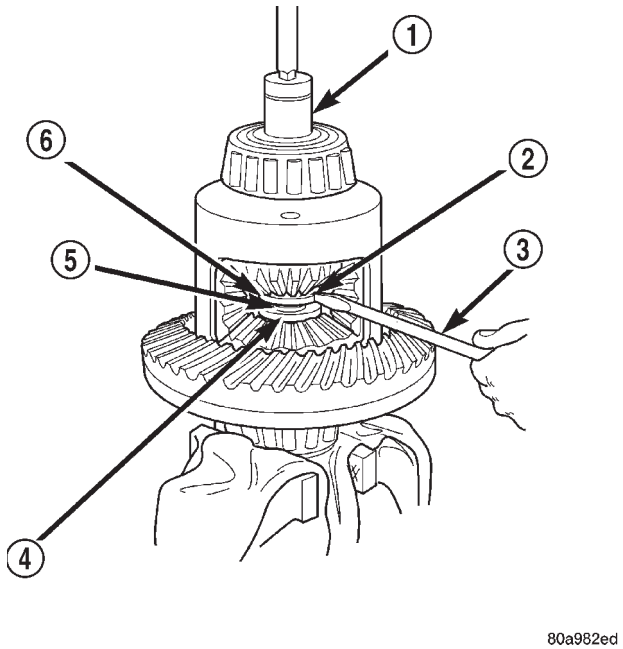


Fig. 48 Threaded Adapter Installation

1 – SOCKET
2 – SLOT IN ADAPTER
3 – SCREWDRIVER
4 – DISC 8140–2
5 – THREADED ROD C-6960–4
6 – THREADED ADAPTER DISC 8140–1

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 49).

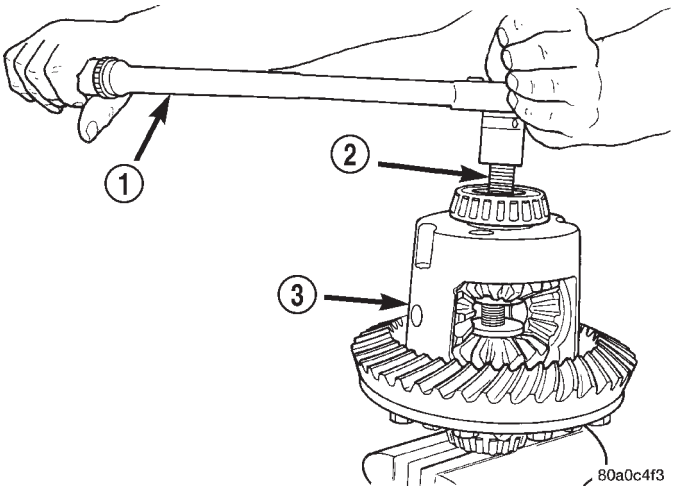


Fig. 49 Tighten Belleville Spring Compressor Tool

1 – TORQUE WRENCH
2 – TOOL ASSEMBLED
3 – DIFFERENTIAL CASE

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 50).

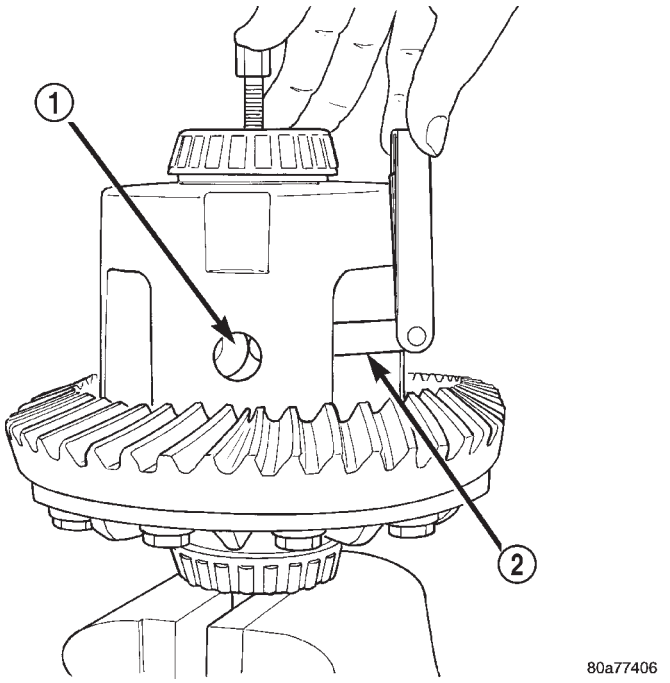


Fig. 50 Remove Pinion Gear Thrust Washer

1 – THRUST WASHER
2 – FEELER GAUGE

(11) Insert Turning Bar 6960-2 in case (Fig. 51).

(12) Loosen the Forcing Screw 6960-4 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar 6960-2.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

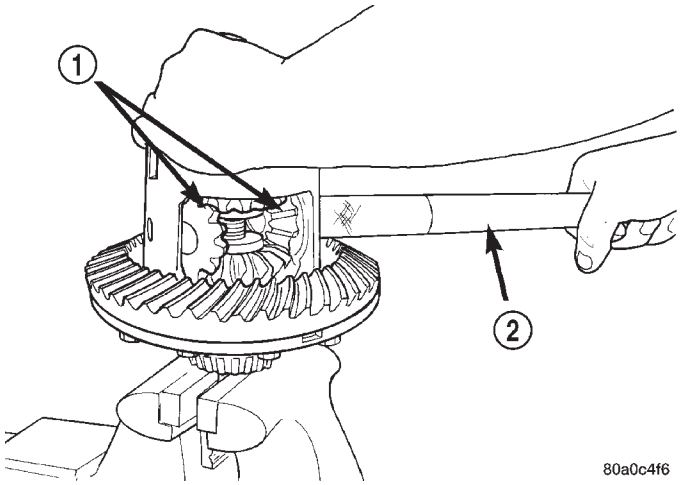


Fig. 51 Pinion Gear Removal

1 – PINION GEARS
2 – TOOL

(15) Remove Forcing Screw 6960-4, Step Plate 8140–2, and Threaded Adapter 8140–1.

DISASSEMBLY AND ASSEMBLY (Continued)

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 52).

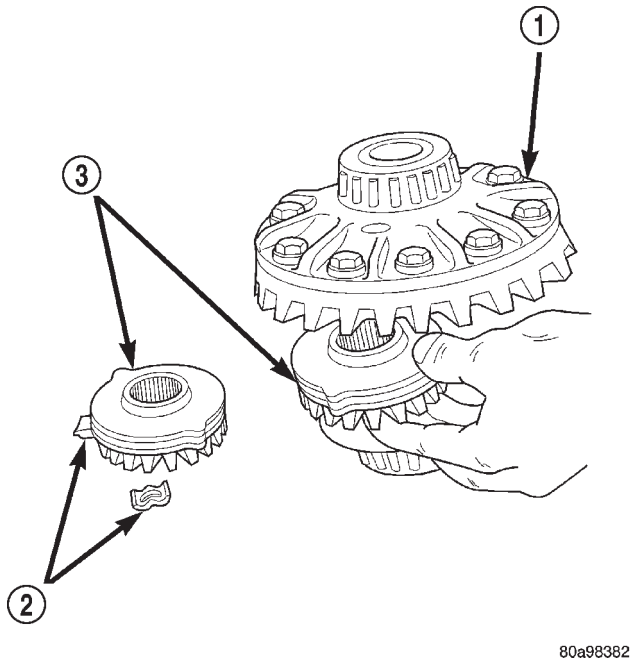


Fig. 52 Side Gear & Clutch Disc Removal

1 – DIFFERENTIAL CASE
2 – RETAINER
3 – SIDE GEAR AND CLUTCH DISC PACK

(17) Remove differential case from Side Gear Holding Tool 8138. Remove side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal.

ASSEMBLY

NOTE: The clutch discs are replaceable as complete sets only. If one clutch disc pack is damaged, both packs must be replaced.

Lubricate each component with gear lubricant before assembly.

(1) Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 53).

(2) Position assembled clutch disc packs on the side gear hubs.

(3) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 54). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(4) Position the differential case on Side Gear Holding Tool 8138.

(5) Install lubricated Step Plate 8140–2 in lower side gear (Fig. 55).

(6) Install the upper side gear and clutch disc pack (Fig. 55).

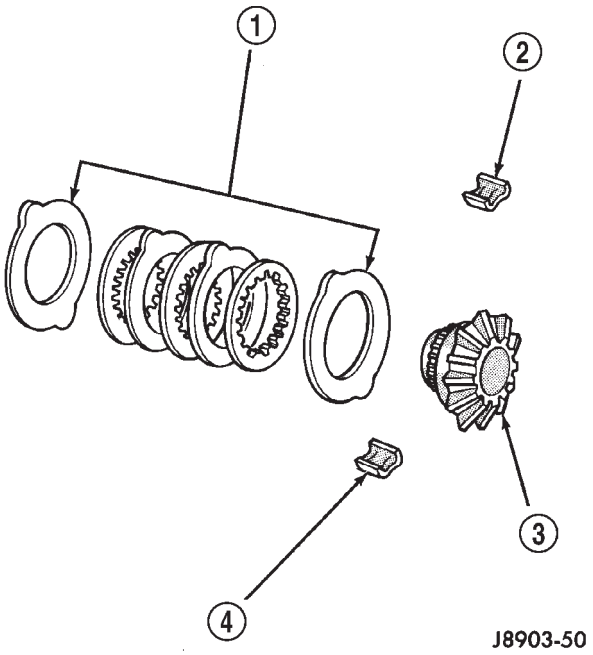


Fig. 53 Clutch Disc Pack

1 – CLUTCH PACK
2 – RETAINER
3 – SIDE GEAR
4 – RETAINER

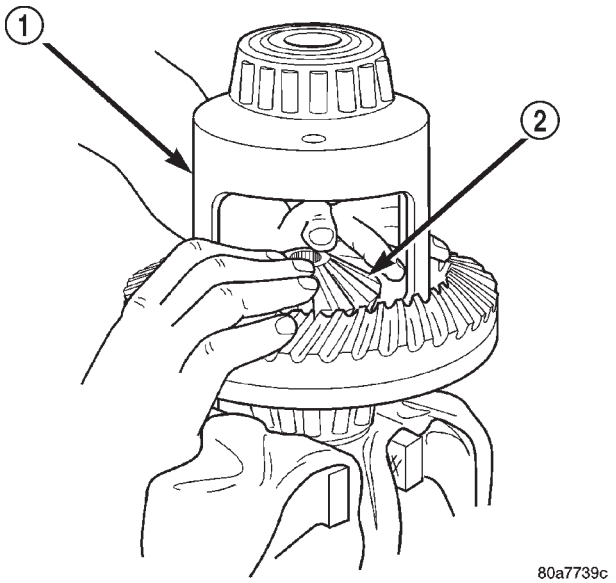


Fig. 54 Clutch Discs & Lower Side Gear Installation

1 – DIFFERENTIAL CASE
2 – LOWER SIDE GEAR AND CLUTCH DISC PACK

(7) Hold assembly in position. Insert Threaded Adapter 8140-1 into top side gear.

(8) Insert Forcing Screw 6960-4.

(9) Tighten forcing screw tool to slightly compress clutch discs.

DISASSEMBLY AND ASSEMBLY (Continued)

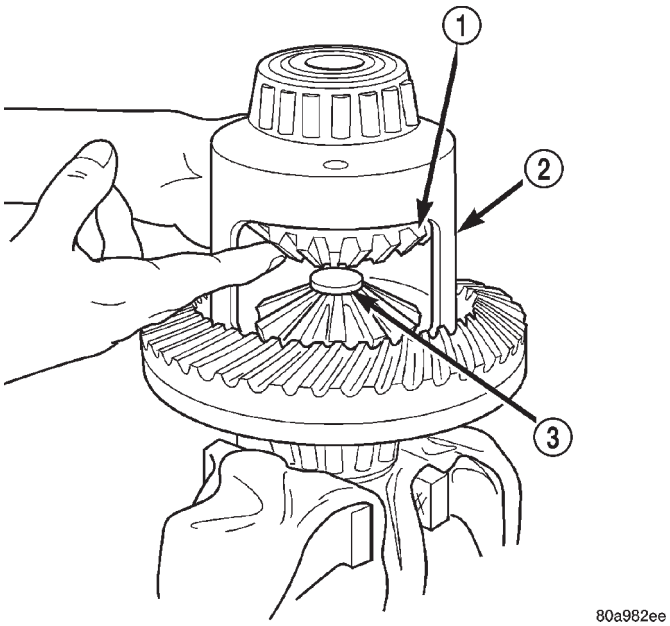


Fig. 55 Upper Side Gear & Clutch Disc Pack Installation

1 – UPPER SIDE GEAR AND CLUTCH DISC PACK
2 – DIFFERENTIAL CASE
3 – SPECIAL TOOL 8140–2

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft holes are aligned.

(11) Rotate case with Turning Bar 6960-2 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw 6960-4, Step Plate 8140–2, and Threaded Adapter 8140-1.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(17) Lubricate all differential components with hypoid gear lubricant.

9 1/4 TRAC-LOK™ DIFFERENTIAL

The Trac–lok™ differential components are illustrated in (Fig. 56). Refer to this illustration during repair service.

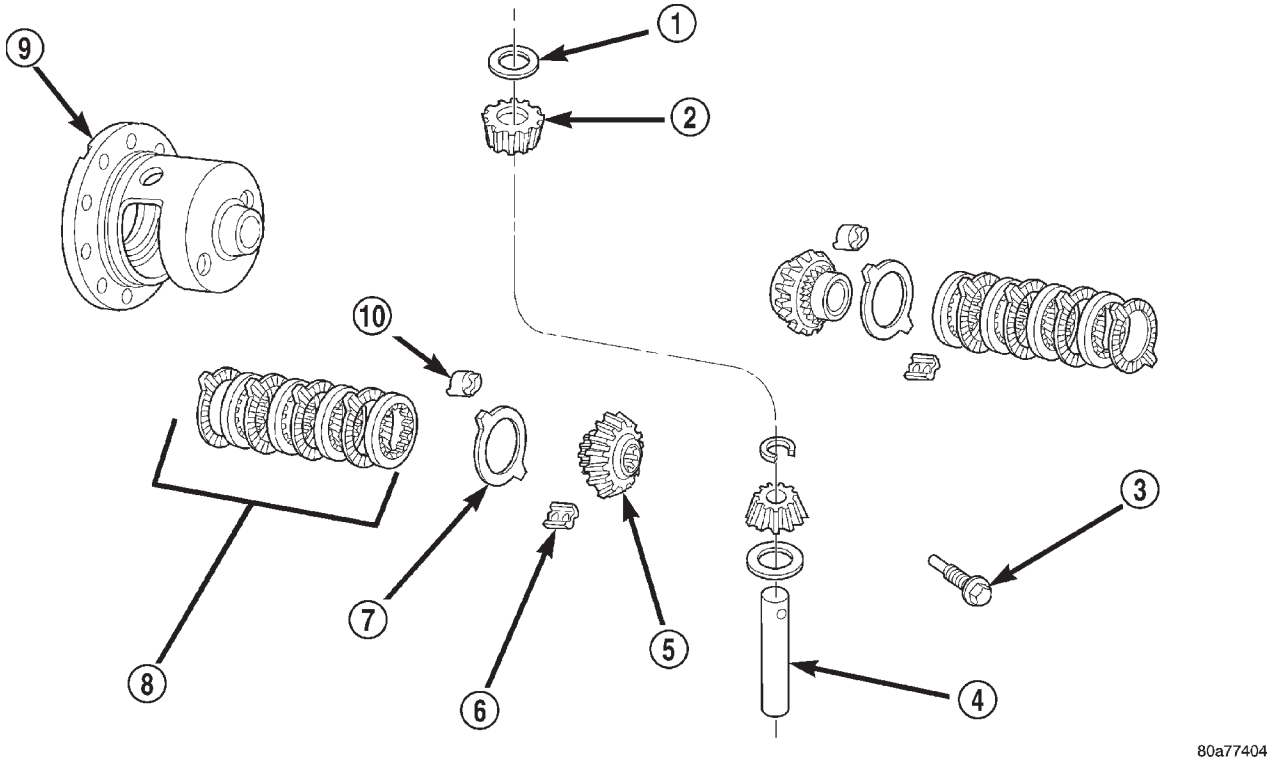


Fig. 56 Trac–lok™ Differential Components

1 – THRUST WASHER
2 – PINION
3 – SHAFT LOCK SCREW
4 – PINION MATE SHAFT
5 – SIDE GEAR
6 – RETAINER
7 – DISC
8 – CLUTCH PACK
9 – DIFFERENTIAL CASE
10 – RETAINER

DISASSEMBLY AND ASSEMBLY (Continued)

DISASSEMBLY

(1) Clamp Side Gear Holding Tool 8136 in a vise.

(2) Position the differential case on Side Gear Holding Tool 8136 (Fig. 57).

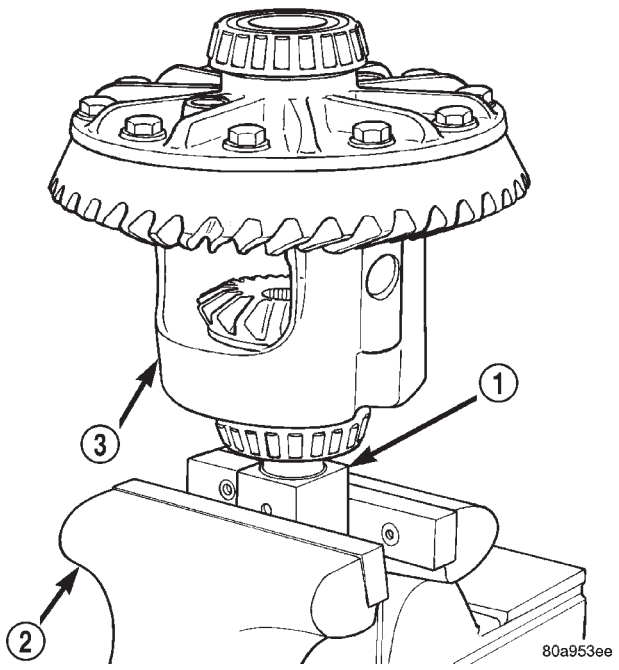


Fig. 57 Differential Case Holding Tool

1 – SIDE GEAR HOLDING TOOL
2 – VISE
3 – DIFFERENTIAL

(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-lok™ differential can be serviced with the ring gear installed.

(4) Remove the pinion gear mate shaft lock screw (Fig. 58).

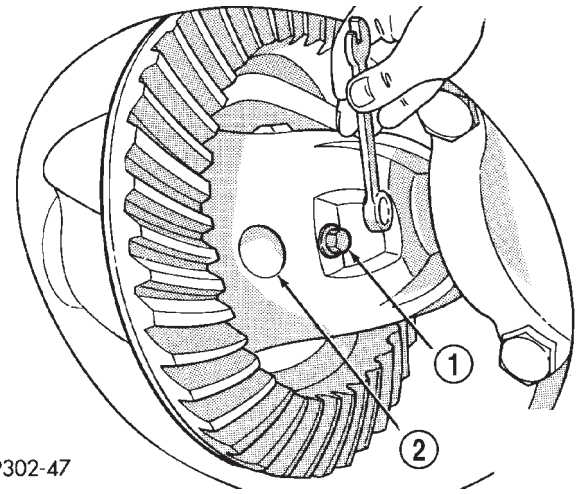


Fig. 58 Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION GEAR MATE SHAFT

(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 59).

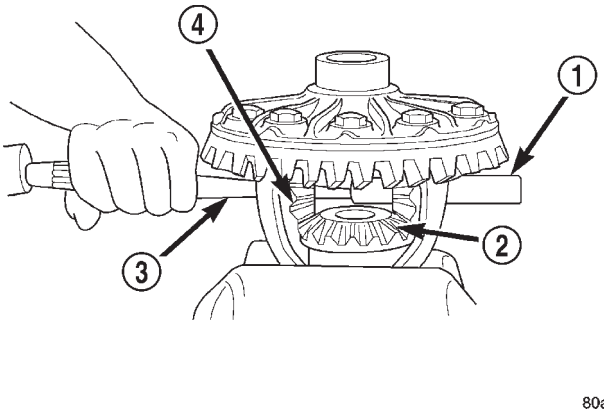


Fig. 59 Mate Shaft Removal

1 – PINION MATE SHAFT
2 – SIDE GEAR
3 – DRIFT
4 – PINION MATE GEAR

(6) Install and lubricate Step Plate 8139-2 (Fig. 60).

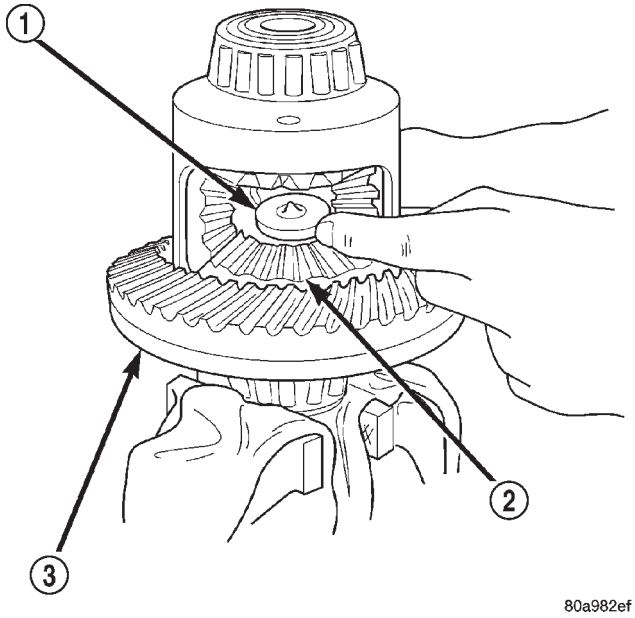


Fig. 60 Step Plate Tool Installation

1 – SPECIAL TOOL 8139–2
2 – LOWER SIDE GEAR
3 – DIFFERENTIAL CASE

(7) Assemble Threaded Adapter 8139-1 into top side gear. Thread Forcing Screw C-4487-2 into adapter until it becomes centered in adapter plate.

(8) Position a small screw driver in slot of Threaded Adapter 8139-1 (Fig. 61) to prevent adapter from turning.

DISASSEMBLY AND ASSEMBLY (Continued)

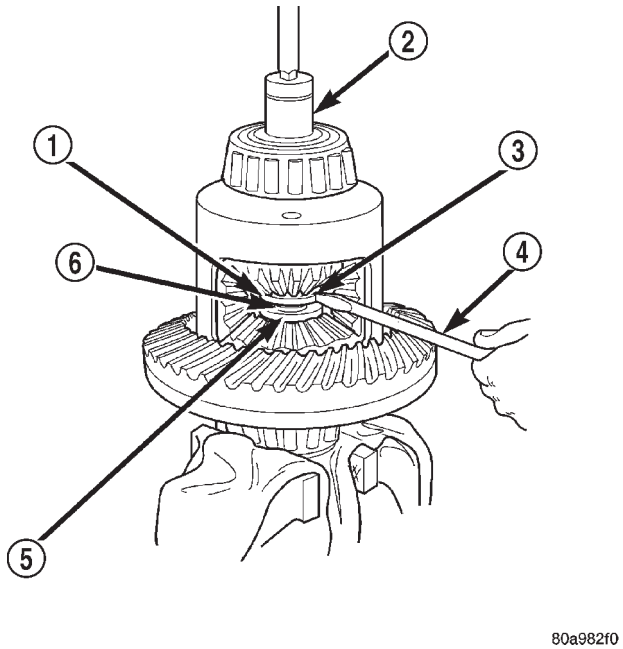


Fig. 61 Threaded Adapter Installation

1 – THREADED ADAPTER DISC 8139–1
2 – SOCKET
3 – SLOT IN ADAPTER
4 – SCREWDRIVER
5 – DISC 8139–2
6 – THREADED ROD C-4487–2

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 62).

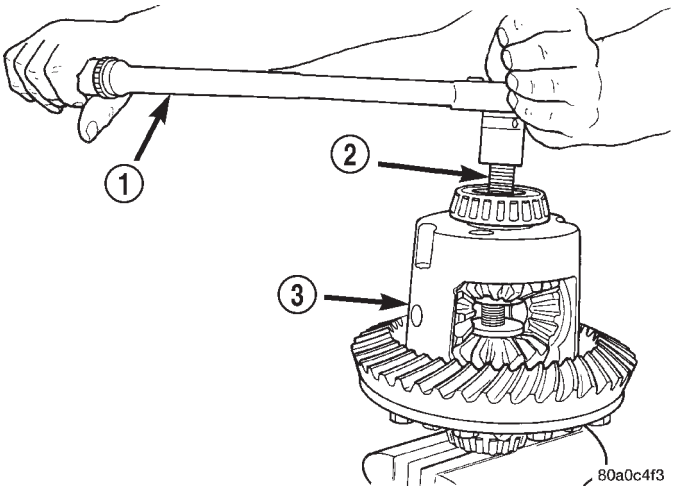


Fig. 62 Tighten Belleville Spring Compressor Tool

1 – TORQUE WRENCH
2 – TOOL ASSEMBLED
3 – DIFFERENTIAL CASE

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 63).

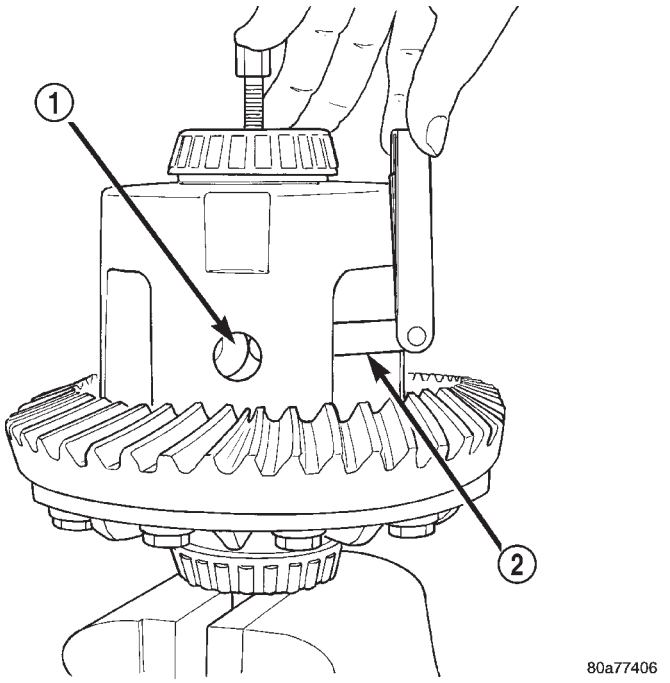


Fig. 63 Remove Pinion Gear Thrust Washer

1 – THRUST WASHER
2 – FEELER GAUGE

(11) Insert Turning Bar C-4487-4 in case (Fig. 64).

(12) Loosen the Forcing Screw C-4487-2 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar C-4487-4.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

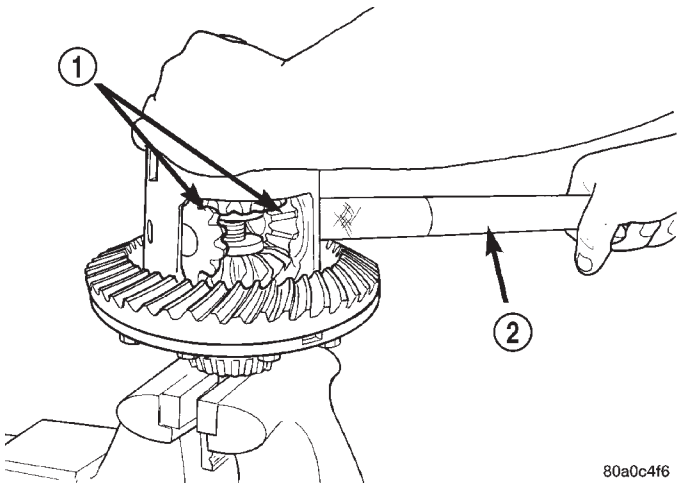


Fig. 64 Pinion Gear Removal

1 – PINION GEARS
2 – TOOL

DISASSEMBLY AND ASSEMBLY (Continued)

(15) Remove Forcing Screw C-4487-2, Step Plate 8139–2, and Threaded Adapter 8139-1.

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 65).

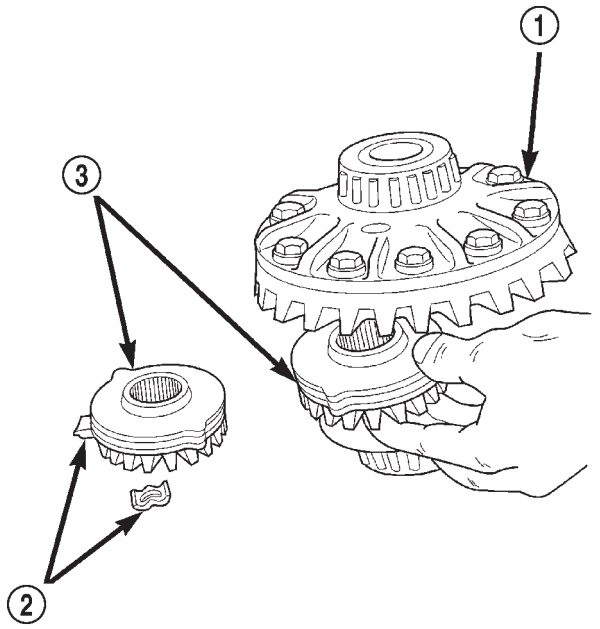


Fig. 65 Side Gear & Clutch Disc Removal

1 – DIFFERENTIAL CASE
2 – RETAINER
3 – SIDE GEAR AND CLUTCH DISC PACK

(17) Remove differential case from Side Gear Holding Tool 8136. Remove side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal.

ASSEMBLY

NOTE: The clutch discs are replaceable as complete sets only. If one clutch disc pack is damaged, both packs must be replaced.

Lubricate each component with gear lubricant before assembly.

(1) Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 66).

(2) Position assembled clutch disc packs on the side gear hubs.

(3) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 67). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(4) Position the differential case on Side Gear Holding Tool 8136.

(5) Install lubricated Step Plate 8139-2 in lower side gear (Fig. 68).

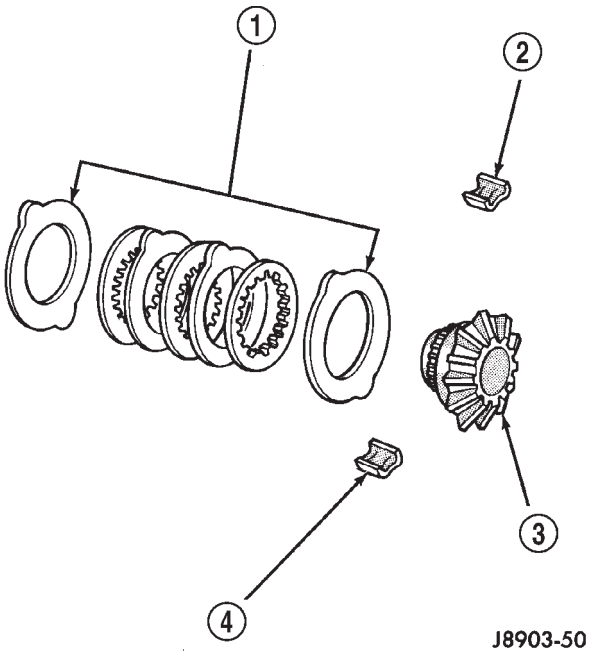


Fig. 66 Clutch Disc Pack

1 – CLUTCH PACK
2 – RETAINER
3 – SIDE GEAR
4 – RETAINER

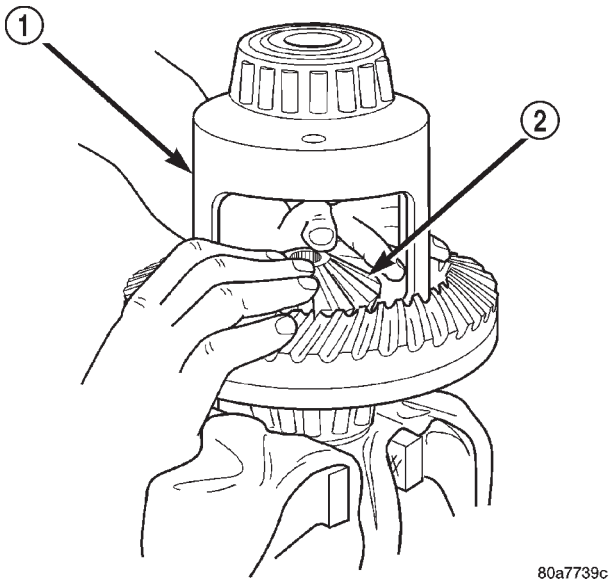


Fig. 67 Clutch Discs & Lower Side Gear Installation

1 – DIFFERENTIAL CASE
2 – LOWER SIDE GEAR AND CLUTCH DISC PACK

(6) Install the upper side gear and clutch disc pack (Fig. 68).

(7) Hold assembly in position. Insert Threaded Adapter 8139-1 into top side gear.

(8) Insert Forcing Screw C-4487-2.

DISASSEMBLY AND ASSEMBLY (Continued)

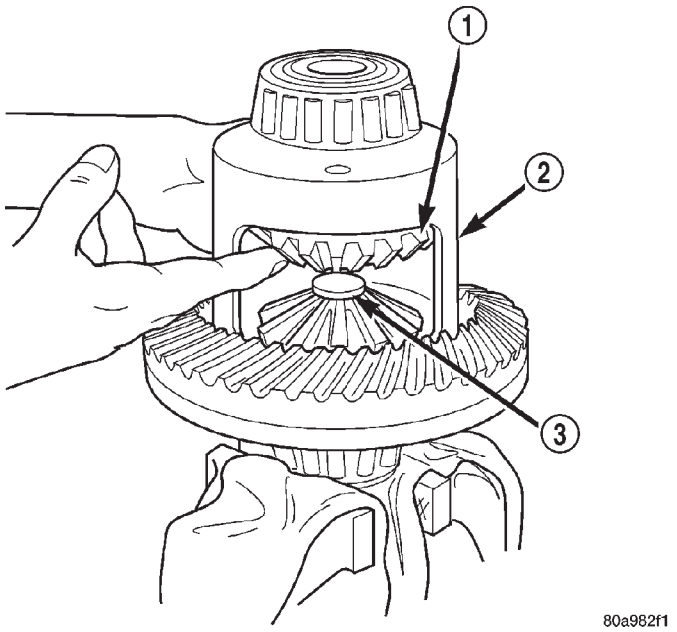


Fig. 68 Upper Side Gear & Clutch Disc Pack Installation

1 – UPPER SIDE GEAR AND CLUTCH DISC PACK
2 – DIFFERENTIAL CASE
3 – SPECIAL TOOL 8139–2

(9) Tighten forcing screw tool to slightly compress clutch discs.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft holes are aligned.

(11) Rotate case with Turning Bar C-4487-4 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw C-4487-2, Step Plate 8139-2, and Threaded Adapter 8139-1.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(17) Lubricate all differential components with hypoid gear lubricant.

CLEANING AND INSPECTION

8 1/4 AND 9 1/4 AXLES

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle tubes and oil channels in housing.

Inspect for:

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion mate shaft, differential pinions, side gears and thrust washers. Replace as a matched set only.
- Ring gear and pinion for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Pinion companion flange for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Pinion depth shims for damage and distortion. Install new shims if necessary.
- The differential case. Replace the case if cracked or damaged.
- The axle shaft C-locks for cracks and excessive wear. Replace them if necessary.
- Each threaded adjuster to determine if it rotates freely. If an adjuster binds, repair the damaged threads or replace the adjuster.
- The RWAL exciter ring for damage and missing teeth. Verify that the ring is fully seated to the differential case flange.

Polish each axle shaft sealing surface with No. 600 crocus cloth. This can remove slight surface damage. Do not reduce the diameter of the axle shaft seal contact surface. When polishing, the crocus cloth should be moved around the circumference of the shaft (not in-line with the shaft).

CLEANING AND INSPECTION (Continued)

TRAC-LOK™

Clean all components in cleaning solvent. Dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side gears and pinions. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

ADJUSTMENTS

8 1/4 AXLE PINION GEAR DEPTH

GENERAL INFORMATION

Ring gear and pinion are supplied as matched sets only. The identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (–) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed behind the rear pinion bearing (Fig. 69).

If a new gear set is being installed, note the depth variance marked on both the original and replacement pinion. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the painted number on the shaft of the pinion gear (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

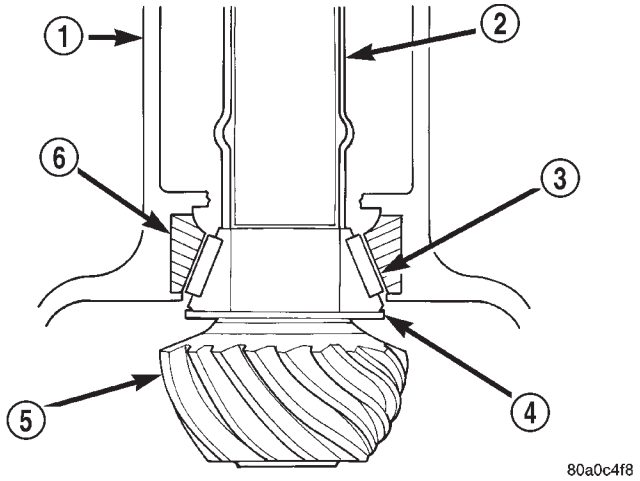


Fig. 69 Shim Locations

1 – AXLE HOUSING
2 – COLLAPSIBLE SPACER
3 – PINION BEARING
4 – PINION DEPTH SHIM
5 – PINION GEAR
6 – BEARING CUP

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the axle housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 70).

(1) Assemble Pinion Height Block 6739, Pinion Block 8540, and rear pinion bearing onto Screw 6741 (Fig. 70).

(2) Insert assembled height gauge components, rear bearing, and screw into axle housing through pinion bearing cups (Fig. 71).

(3) Install front pinion bearing and Cone-Nut 6740 hand tight (Fig. 70).

(4) Place Arbor Disc 8541 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 72). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

NOTE: Arbor Discs 8541 has different step diameters to fit other axles. Choose proper step for axle being serviced.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 70). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

ADJUSTMENTS (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

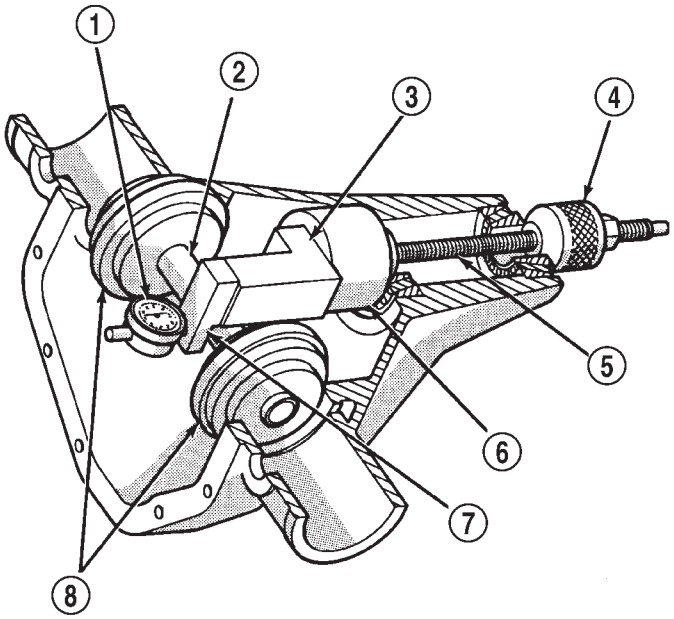


Fig. 70 Pinion Gear Depth Gauge Tools

1 – DIAL INDICATOR
2 – ARBOR
3 – PINION HEIGHT BLOCK
4 – CONE
5 – SCREW
6 – PINION BLOCK
7 – SCOOTER BLOCK
8 – ARBOR DISC

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 73). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading.

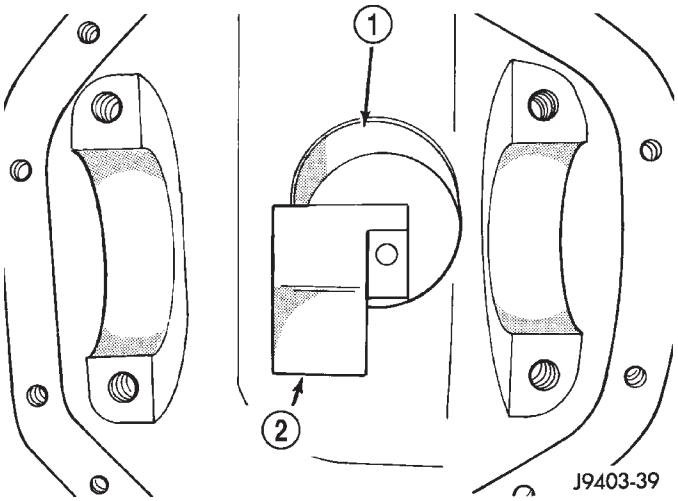


Fig. 71 Pinion Height Block

1 – PINION BLOCK
2 – PINION HEIGHT BLOCK

If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number painted in the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

9 1/4 AXLE PINION GEAR DEPTH

GENERAL INFORMATION

Ring gear and pinion are supplied as matched sets only. The identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (–) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number

ADJUSTMENTS (Continued)

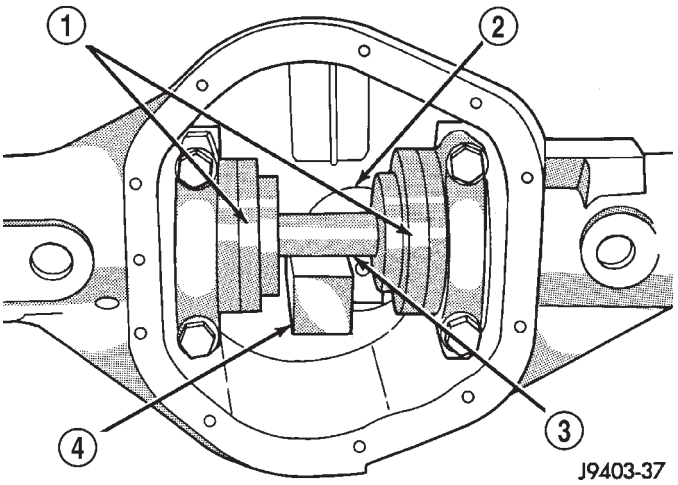


Fig. 72 Gauge Tools In Housing

1 – ARBOR DISC
2 – PINION BLOCK
3 – ARBOR
4 – PINION HEIGHT BLOCK

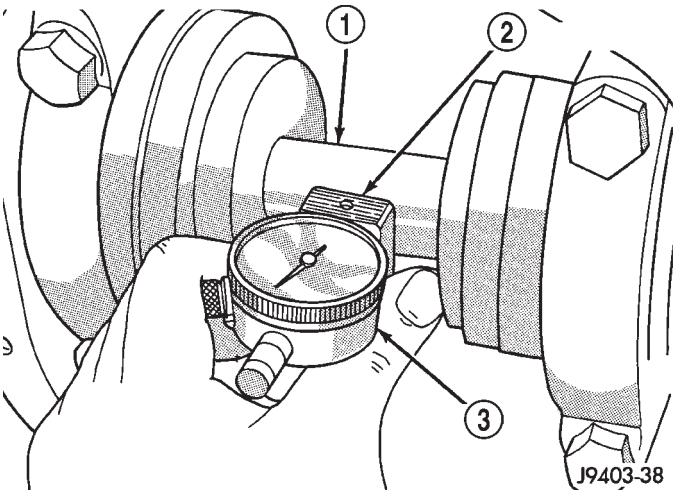


Fig. 73 Pinion Gear Depth Measurement

1 – ARBOR
2 – SCOOTER BLOCK
3 – DIAL INDICATOR

is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed behind the rear pinion bearing (Fig. 74).

If a new gear set is being installed, note the depth variance painted onto both the original and replacement pinion. Add or subtract the thickness of the

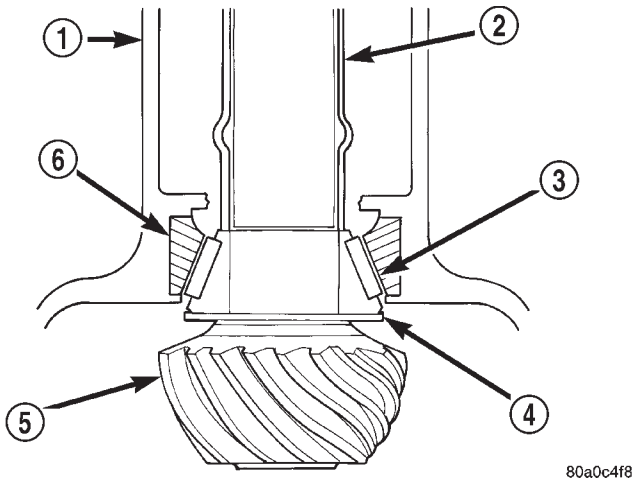


Fig. 74 Shim Locations

1 – AXLE HOUSING
2 – COLLAPSIBLE SPACER
3 – PINION BEARING
4 – PINION DEPTH SHIM
5 – PINION GEAR
6 – BEARING CUP

original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the painted number on the shaft of the drive pinion (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the axle housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 75).

(1) Assemble Pinion Height Block 6739, Pinion Block 8542, and rear pinion bearing onto Screw 6741 (Fig. 75).

(2) Insert assembled height gauge components, rear bearing, and screw into axle housing through pinion bearing cups (Fig. 76).

(3) Install front pinion bearing and Cone-Nut 6740 hand tight (Fig. 75).

(4) Place Arbor Disc 8541 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 77). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

ADJUSTMENTS (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

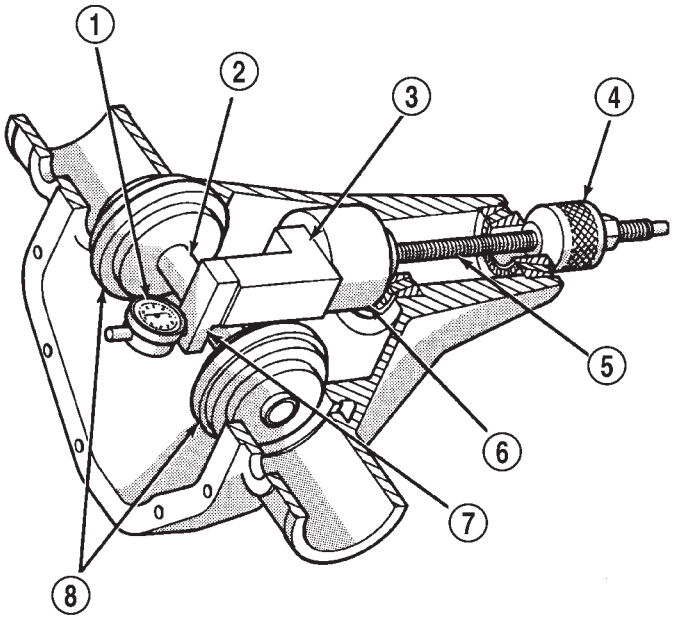


Fig. 75 Pinion Gear Depth Gauge Tools

1 – DIAL INDICATOR
2 – ARBOR
3 – PINION HEIGHT BLOCK
4 – CONE
5 – SCREW
6 – PINION BLOCK
7 – SCOOTER BLOCK
8 – ARBOR DISC

NOTE: Arbor Discs 8541 has different step diameters to fit other axles. Choose proper step for axle being serviced.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 75). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

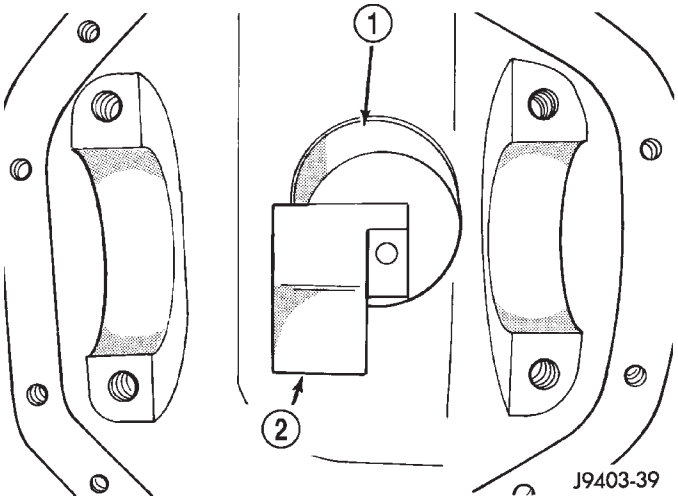


Fig. 76 Pinion Height Block

1 – PINION BLOCK
2 – PINION HEIGHT BLOCK

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 78). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

ADJUSTMENTS (Continued)

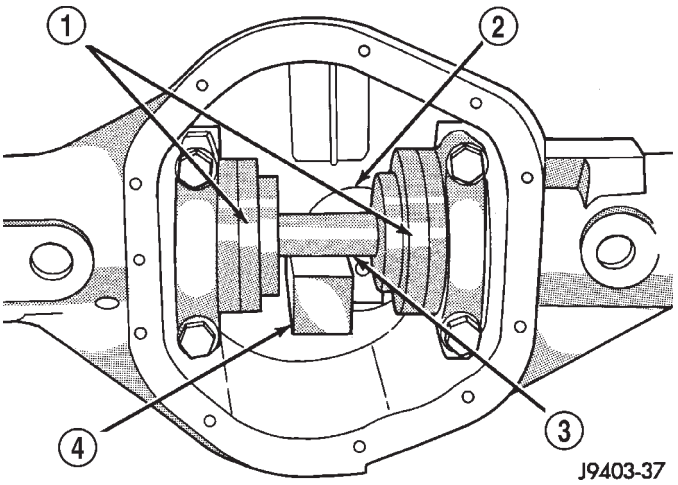


Fig. 77 Gauge Tools In Housing

1 – ARBOR DISC
2 – PINION BLOCK
3 – ARBOR
4 – PINION HEIGHT BLOCK

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number marked on the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

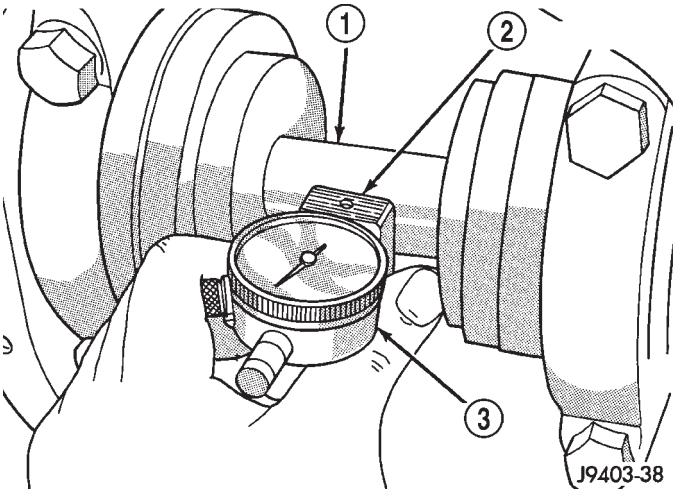


Fig. 78 Pinion Gear Depth Measurement

1 – ARBOR
2 – SCOOTER BLOCK
3 – DIAL INDICATOR

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

The following must be considered when adjusting bearing preload and gear backlash:

- The maximum ring gear backlash variation is 0.003 inch (0.076 mm).
- Mark the gears so the same teeth are meshed during all backlash measurements.
- Maintain the torque while adjusting the bearing preload and ring gear backlash.
- Excessive adjuster torque will introduce a high bearing load and cause premature bearing failure. Insufficient adjuster torque can result in excessive differential case free-play and ring gear noise.
- Insufficient adjuster torque will not support the ring gear correctly and can cause excessive differential case free-play and ring gear noise.

NOTE: The differential bearing cups will not always immediately follow the threaded adjusters as they are moved during adjustment. To ensure accurate bearing cup responses to the adjustments:

- **Maintain the gear teeth engaged (meshed) as marked.**
- **The bearings must be seated by rapidly rotating the pinion gear a half turn back and forth.**
- **Do this five to ten times each time the threaded adjusters are adjusted.**

(1) Use Wrench C-4164 to adjust each threaded adjuster inward until the differential bearing free-play is eliminated (Fig. 79). Allow some ring gear backlash (approximately 0.01 inch/0.25 mm) between the ring and pinion gear. Seat the bearing cups with the procedure described above.

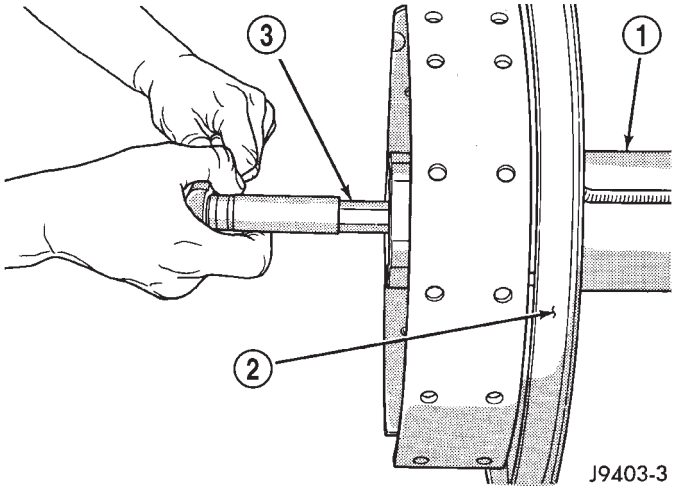


Fig. 79 Threaded Adjuster Tool

1 – AXLE TUBE
2 – BACKING PLATE
3 – TOOL C-4164

(2) Install dial indicator and position the plunger against the drive side of a ring gear tooth (Fig. 80). Measure the backlash at 4 positions (90 degrees apart) around the ring gear. Locate and mark the area of minimum backlash.

ADJUSTMENTS (Continued)

(3) Rotate the ring gear to the position of the least backlash. Mark the gear so that all future backlash measurements will be taken with the same gear teeth meshed.

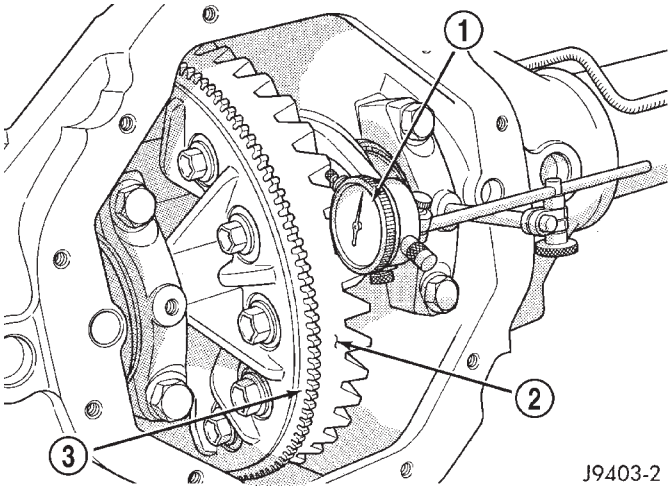


Fig. 80 Ring Gear Backlash Measurement

1 – DIAL INDICATOR
2 – RING GEAR
3 – EXCITER RING

(4) Loosen the right-side, tighten the left-side threaded adjuster. Obtain backlash of 0.003 to 0.004 inch (0.076 to 0.102 mm) with each adjuster tightened to 14 N·m (10 ft. lbs.). Seat the bearing cups with the procedure described above.

(5) Tighten the differential bearing cap bolts;

- 8 1/4 axles: 95 N·m (70 ft. lbs.)
- 9 1/4 axles: 136 N·m (100 ft. lbs.)

(6) Tighten the right-side threaded adjuster to 102 N·m (75 ft. lbs.). Seat the bearing cups with the procedure described above. Continue to tighten the right-side adjuster and seat bearing cups until the torque remains constant at 102 N·m (75 ft. lbs.)

(7) Measure the ring gear backlash. The range of backlash is 0.006 to 0.008 inch (0.15 to 0.203 mm).

(8) Continue increasing the torque at the right-side threaded adjuster until the specified backlash is obtained.

NOTE: The left-side threaded adjuster torque should have approximately 102 N·m (75 ft. lbs.). If the torque is considerably less, the complete adjustment procedure must be repeated.

(9) Tighten the left-side threaded adjuster until 102 N·m (75 ft. lbs.) torque is indicated. Seat the bearing rollers with the procedure described above. Do this until the torque remains constant.

(10) Install the threaded adjuster locks and tighten the lock screws to 10 N·m (90 in. lbs.).

After the proper backlash is achieved, perform the Gear Contact Analysis procedure.

GEAR CONTACT PATTERN ANALYSIS

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

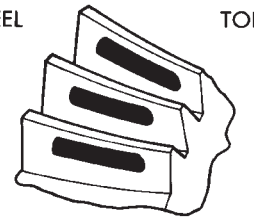
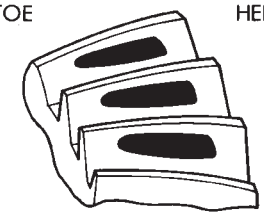
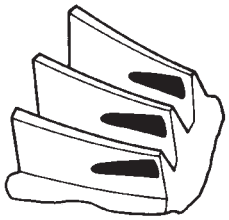
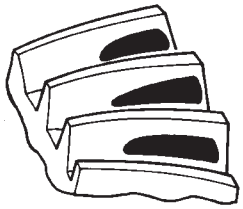
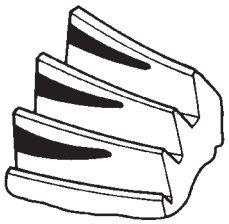
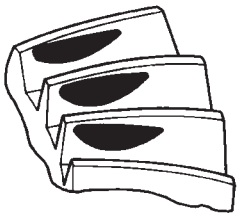
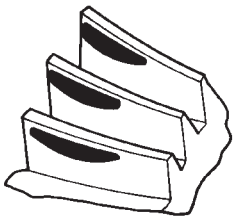
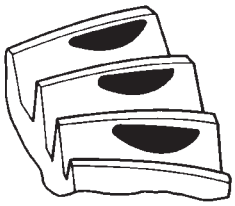
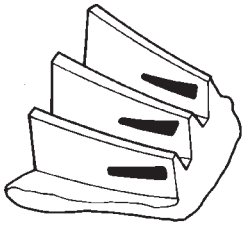
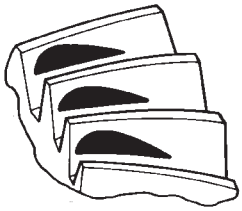
(1) Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 81) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)

DRIVE SIDE OF RING GEAR TEETH	COAST SIDE OF RING GEAR TEETH	
HEEL TOE 	TOE HEEL 	DESIRABLE CONTACT PATTERN. PATTERN SHOULD BE CENTERED ON THE DRIVE SIDE OF TOOTH. PATTERN SHOULD BE CENTERED ON THE COAST SIDE OF TOOTH, BUT MAY BE SLIGHTLY TOWARD THE TOE. THERE SHOULD ALWAYS BE SOME CLEARANCE BETWEEN CONTACT PATTERN AND TOP OF THE TOOTH.
		RING GEAR BACKLASH CORRECT. **THINNER** PINION GEAR DEPTH SHIM REQUIRED.
		RING GEAR BACKLASH CORRECT. **THICKER** PINION GEAR DEPTH SHIM REQUIRED.
		PINION GEAR DEPTH SHIM CORRECT. **DECREASE** RING GEAR BACKLASH.
		PINION GEAR DEPTH SHIM CORRECT. **INCREASE** RING GEAR BACKLASH.

J9003-24

Fig. 81 Gear Tooth Contact Patterns

ADJUSTMENTS (Continued)

SIDE GEAR CLEARANCE

When measuring side gear clearance, check each gear independently. If it necessary to replace a side gear, replace both gears as a matched set.

(1) Install the axle shafts and C-locks and pinion mate shaft.

(2) Measure each side gear clearance. Insert a matched pair of feeler gauge blades between the gear and differential housing on opposite sides of the hub (Fig. 82).

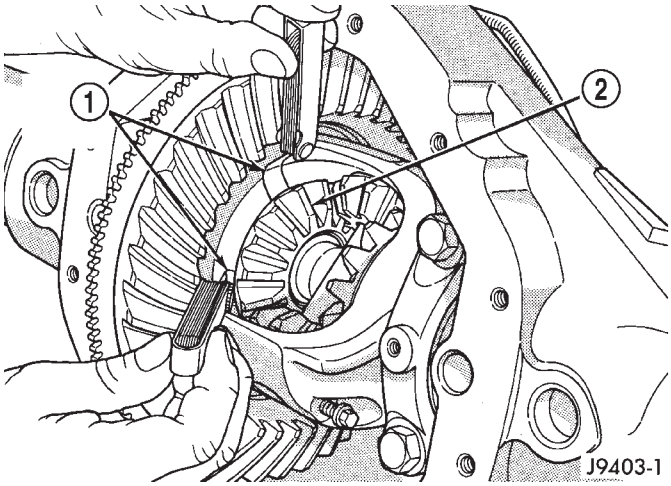


Fig. 82 Side Gear Clearance Measurement

1 – FEELER GAUGE BLADES
2 – SIDE GEAR

(3) If side gear clearances is no more than 0.005 inch. Determine if the axle shaft is contacting the pinion mate shaft. **Do not remove the feeler gauges, inspect the axle shaft with the feeler gauge inserted behind the side gear.** If the end of the axle shaft is not contacting the pinion mate shaft, the side gear clearance is acceptable.

(4) If clearance is more than 0.005 inch (axle shaft not contacting mate shaft), record the side gear clearance. Remove the thrust washer and measure its thickness with a micrometer. Add the washer thickness to the recorded side gear clearance. The sum of gear clearance and washer thickness will determine required thickness of replacement thrust washer (Fig. 83).

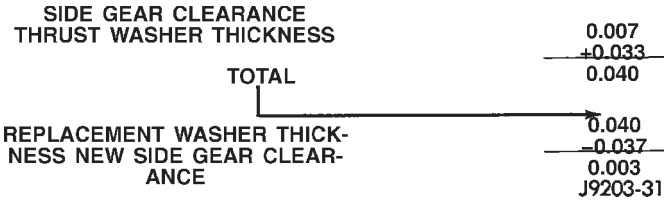


Fig. 83 Side Gear Calculations

In some cases, the end of the axle shaft will move and contact the mate shaft when the feeler gauge is inserted. The C-lock is preventing the side gear from sliding on the axle shaft.

(5) If there is no side gear clearance, remove the C-lock from the axle shaft. Use a micrometer to measure the thrust washer thickness. Record the thickness and re-install the thrust washer. Assemble the differential case without the C-lock installed and re-measure the side gear clearance.

(6) Compare both clearance measurements. If the difference is less than 0.012 inch (0.305 mm), add clearance recorded when the C-lock was installed to thrust washer thickness measured. The sum will determine the required thickness of the replacement thrust washer.

(7) If clearance is 0.012 inch (0.305 mm) or greater, both side gears must be replaced (matched set) and the clearance measurements repeated.

(8) If clearance (above) continues to be 0.012 inch (0.305 mm) or greater, the case must be replaced.

SPECIFICATIONS

8 1/4 INCH AXLE

Axle Type	Semi-floating, hypoid
Lubricant	SAE 80W-90
Lube Capacity	2.22 L (4.7 pts.)
Trac-Lok Additive	148 ml (5 oz.)
Axle Ratio	3.21, 3.55, 3.92
Differential	
Case Clearance	0.12 mm (0.005 in.)
Case Flange Runout	0.076 mm (0.003 in.)
Ring Gear	
Diameter	20.95 cm (8.25 in.)
Backlash	0.12-0.20 mm (0.005-0.008 in.)
Runout	0.127 mm (0.005 in.)
Pinion Bearing Preload	
Original	1-2 N·m (10-20 in.lbs.)
New	2-5 N·m (15-35 in.lbs.)

9 1/4 INCH AXLE

Axle Type	Semi-floating, hypoid
Lubricant	SAE 75W-90
Lube Capacity	2.32 L (4.9 pts.)
Trac-lok Additive	148 ml (5 oz.)
Axle Ratio	3.21, 3.55, 3.92
Differential	
Case Flange Runout	0.076 mm (0.003 in.)
Ring gear	
Diameter	23.50 cm (9.25 in.)
Backlash	0.12-0.20 mm (0.005-0.008 in.)
Runout	0.127 mm (0.005 in.)
Pinion Bearing Preload	
Original	1-2 N·m (10-20 in.lbs.)
New	2–5 N·m (15–35 in. lbs.)

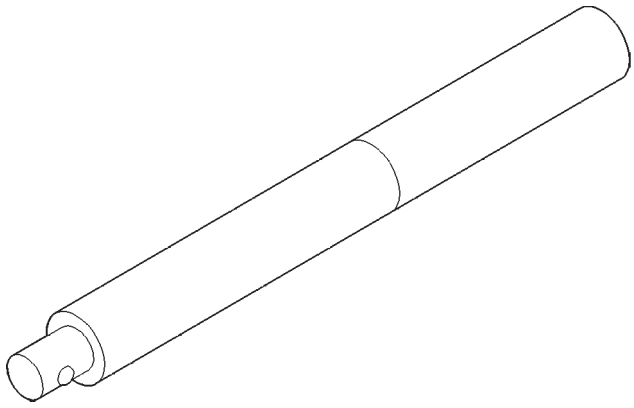
SPECIFICATIONS (Continued)

8 1/4 and 9 1/4 INCH AXLE

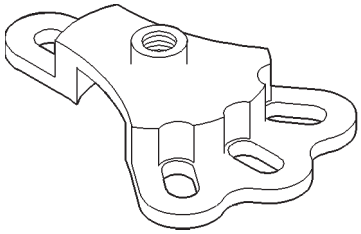
DESCRIPTION	TORQUE
Diff. Cover Bolt	41 N·m (30 ft. lbs.)
Bearing Cap Bolt—8 1/4 Axle	95 N·m (70 ft. lbs.)
Bearing Cap Bolt—9 1/4 Axle	136 N·m (100 ft. lbs.)
Pinion Nut	285 N·m (210 ft. lbs.)
Ring Gear Bolt—8 1/4 Axle	102 N·m (75 ft. lbs.)
Ring Gear Bolt—9 1/4 Axle	157 N·m (115 ft. lbs.)
Backing Plate Bolt	64 N·m (48 ft. lbs.)
RWAL/ABS Sensor Bolt	24 N·m (18. ft. lbs.)
Threaded Adjuster Lock Screw	10 N·m (90 in. lbs.)

SPECIAL TOOLS

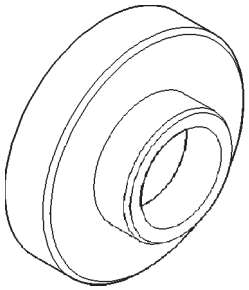
8 1/4 AND 9 1/4 AXLES



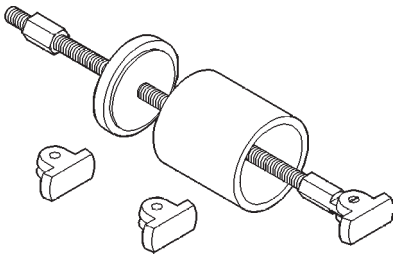
Handle—C-4171



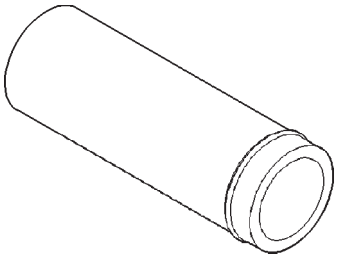
Puller, Hub—6790



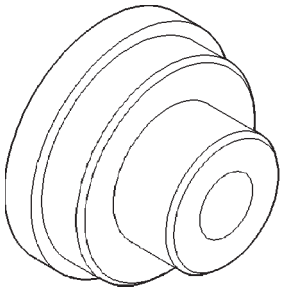
Installer—C-4076-B



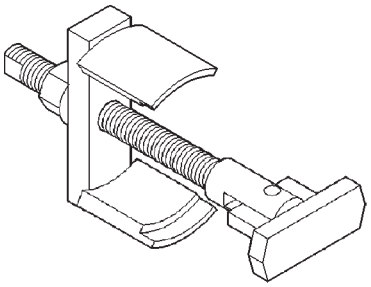
Remover, Bearing—6310



Handle—C-4735-1

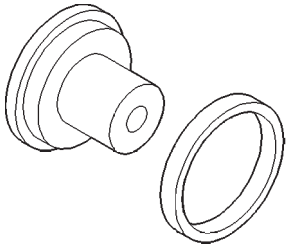


Installer—C-4198

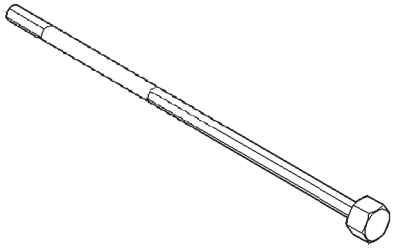


Remover—C-4828

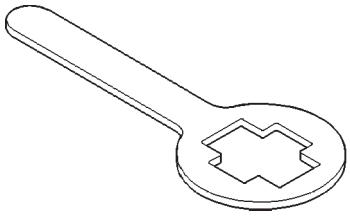
SPECIAL TOOLS (Continued)



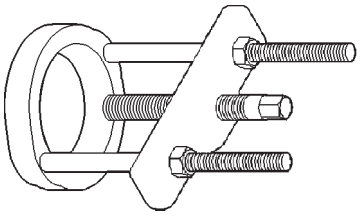
Installer—C-4826



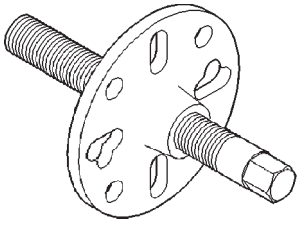
Adjustment Rod—C-4164



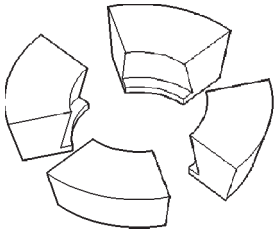
Holder—6719



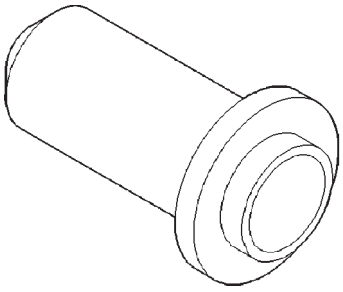
Puller/Press—C-293–PA



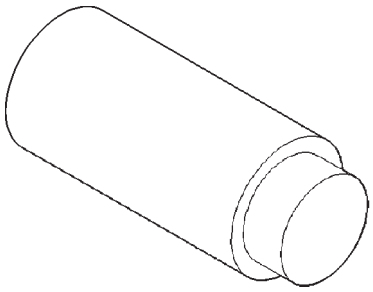
Puller—C-452



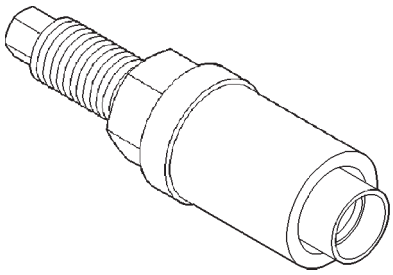
Adapters—C-293-48



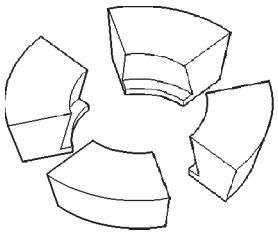
Installer—C-3860-A



Plug—SP-3289

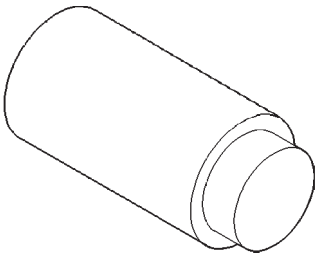


Installer—C-3718

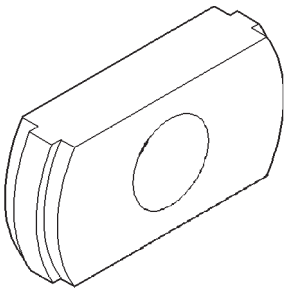


Adapters—C-293-47

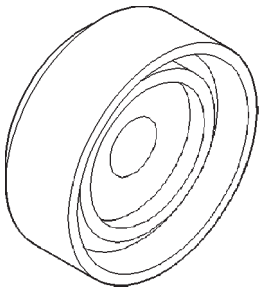
SPECIAL TOOLS (Continued)



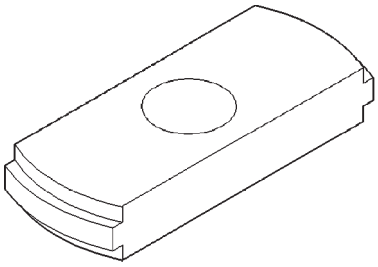
Plug—C-293-3



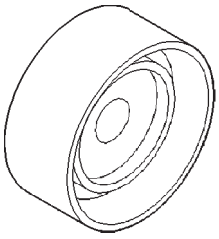
Installer—C-4345



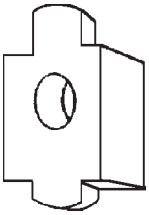
Installer—C-4340



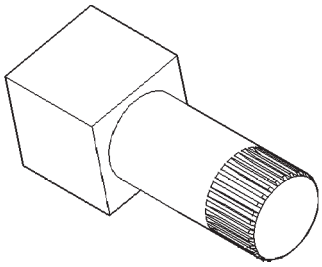
Remover—C-4307



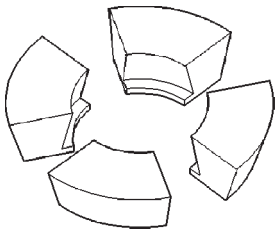
Installer—C-4213



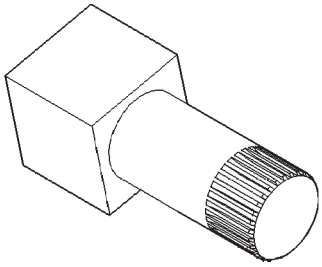
Remover—C-4309



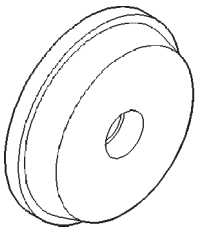
Holder—8136



Adapters—C-293-37

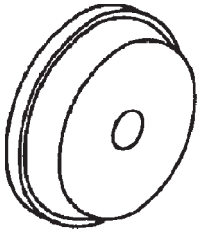


Holder—8138

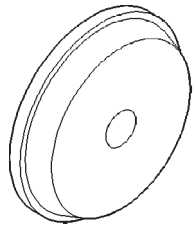


Installer—C-4308

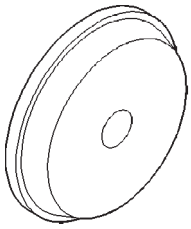
SPECIAL TOOLS (Continued)



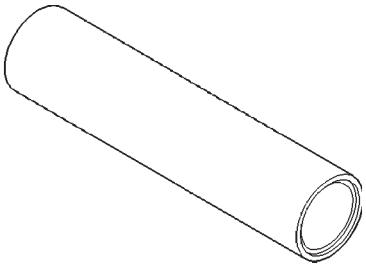
Installer—C-4310



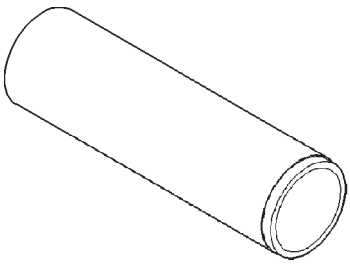
Installer—D-130



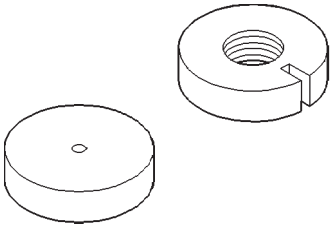
Installer—D-129



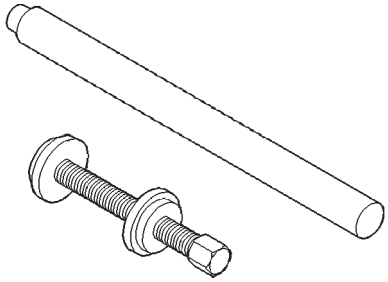
Installer—6448



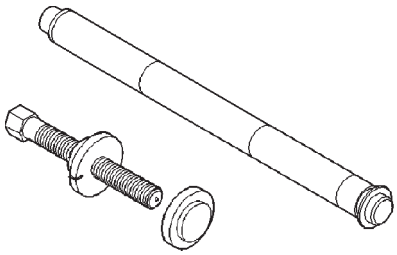
Installer—C-3095



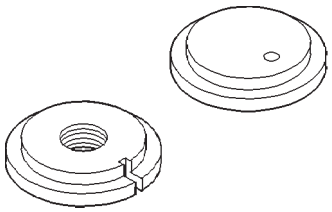
Trac-lok Tools—8140



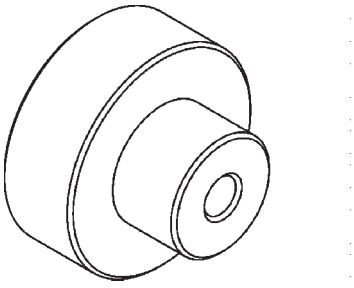
Trac-lok Tools—6960



Trac-lok Tools—C-4487

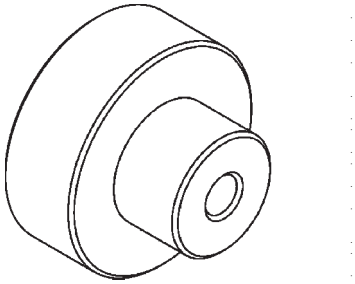


Trac-lok Tools—8139

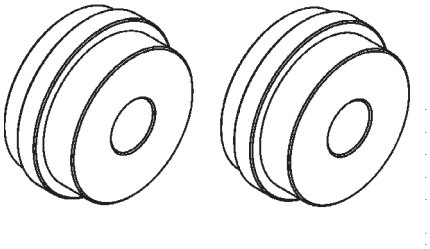


Pinion Gauge Block—8540

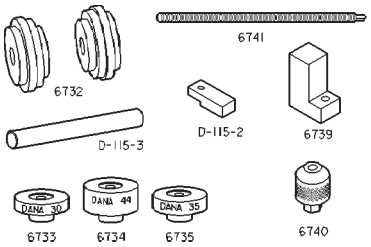
SPECIAL TOOLS (Continued)



Pinion Gauge Block—8542



Arbor Discs—8541



Pinion Gauge Set